Fourth Five-Year Review Report
for
Jadco-Hughes Facility Superfund Site
NCD980729602

Belmont
Gaston County, North Carolina

July 2016

United States Environmental Protection Agency
Region 4
Atlanta, Georgia

Approved by:

Franklin E. Hill
Director, Superfund Division

Date: 9/26/16

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for
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NC Hwy 2035
Belmont
Gaston County, North Carolina

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List of Acronyms

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BNA	Base Neutral and Acids
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CRA	Conestoga-Rovers & Associates
DCA	Dichloroethane
DCE	Dichloroethene
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
gpm	Gallons per Minute
IC	Institutional Control
JHSC	Jadco-Hughes Steering Committee
LSEBPS	Large Scale Enhanced Bioremediation Pilot Study
MCL	Maximum Contaminant Level
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
mg/kg	Milligrams per Kilogram
NCDENR	North Carolina Department of the Environment and Natural Resources
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene
PCOR	Preliminary Close-Out Report
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
PW	Pumping Well
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/ Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
TCE	Trichloroethylene
UAO	Unilateral Administrative Order
VOC	Volatile Organic Compound

Executive Summary

The 6-acre Jadco-Hughes Superfund site (the Site) is located on Cason Street in North Belmont, Gaston County, North Carolina. From 1969 until 1975, a waste oil and solvent recovery and disposal facility operated on site. During facility operations, spills of ink solvents, lubricants, petroleum products and other unknown chemicals occurred, contaminating site soils, sediments and groundwater.

The U.S. Environmental Protection Agency selected the remedy in a 1990 Record of Decision (ROD). The remedy for soil and sediments included soil vapor extraction (SVE) and soil flushing. Active soil and sediment remediation is complete, so only natural soil flushing is occurring at the Site. The selected remedy for groundwater included an extraction and treatment system and institutional controls to prevent site groundwater use. The remedy also included access restrictions, long-term monitoring and an on-site culvert to prevent contaminated groundwater discharge to a nearby tributary. The triggering action for this statutory review is the signing of the Site's third five-year review (FYR) on September 29, 2011.

The remedy at the Site currently protects human health and the environment in the short term because active remediation of source soil and sediment contamination is complete; groundwater contamination is being treated; there is no human exposure to contaminated groundwater; and institutional controls have been implemented.

In order for the remedy to be protective over the long term, the following actions need to be taken:

- Determine if the changes in the NC 2L standards necessitate changes to the RGs in the ROD.
- Determine if the drawdown of the groundwater elevation created by the installation of extraction wells PWs 5 & 6 is adequately limiting the migration of contamination towards MW12, and further define the current extent of contamination downgradient of MW12D.
- Determine if additional action is necessary to address continued detection of contamination in surface water and sediment monitoring sampling locations, SS9 and SS14.
- Determine if additional action is necessary to mitigate the increases in COC concentrations in soil leachate samples.
- Evaluate whether groundwater sampling should include the analysis of 1,4-dioxane.
- Evaluate the presence of dioxin and determine if further action is necessary.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Jadco-Hughes Facility		
EPA ID: NCD980729602		
Region: 4	**State:** NC	**City/County:** Belmont/Gaston County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" selected above, enter Agency name:** Click here to enter text.
Author name: Michael Townsend
Author affiliation: EPA Region 4
Review period: December 2015 – September 2016
Date of site inspection: 12/15/2015
Type of review: Statutory
Review number: 4
Triggering action date: 9/27/2011
Due date *(five years after triggering action date)*: 9/27/2016

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1	Issue Category: Changed Site Conditions			
	Issue: The 15A North Carolina Administrative Code (NCAC) 02L groundwater standards were revised in April 2013. This resulted in updated standards for 12 contaminants of concern (COCs) that are more stringent than the remediation goals set in the 1990 ROD.			
	Recommendation: Determine if the changes in the NC 2L standards necessitate changes to the remediation goals in the ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	Issue Category: Remedy Performance			
	Issue: Concentrations of VOCs have increased at monitoring well MW12D, and the soil leachate sample locations since 2013, as well as continued detections of 1,2-DCA at SS9 and SS14.			
	Recommendation: Determine if the drawdown of the groundwater elevation created by the installation of extraction wells PWs 5 & 6 is adequately limiting the migration of contamination towards MW12, and further define the current extent of contamination downgradient of MW12D. Investigate the 1,2-DCA detections at SS9 & 14, and the increasing concentrations at soil leachate sample locations.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	Issue Category: Monitoring
	Issue: 1,4-dioxane is a potential co-contaminant of trichloroethane (TCA) and dichloroethane (DCA), which are present in site groundwater, but 1,4-dioxane is not included in groundwater sampling.
	Recommendation: Evaluate whether groundwater sampling should include the analysis of 1,4-dioxane.

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	Issue Category: Monitoring			
	Issue: There is a small subset of polychlorinated biphenyl (PCB) congeners that display dioxin-like activity. Since congener data are not available for the Site, this may require a review of the Site to confirm dioxin is not a threat to human health and the environment.			
	Recommendation: Investigate the potential presence of dioxin and determine if further action is necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

Sitewide Protectiveness Statement

Protectiveness Determination:
Short-term Protective

Addendum Due Date (if applicable):
Click here to enter date.

Protectiveness Statement:
The remedy at the Site currently protects human and the environment in the short term because active remediation of source soil and sediment contamination is complete, groundwater contamination is being treated, there is no human exposure to contaminated groundwater and most institutional controls have been implemented. For the remedies to be protective over the long term, the following actions need to be taken: determine if the changes in the NC2L standards necessitate changes to the RGs that were in the ROD; determine if the drawdown of the groundwater elevation created by the installation of extraction wells PWs 5 & 6 is adequately limiting the migration of contamination towards MW12, and further define the current extent of contamination downgradient of MW12D; Investigate the 1,2-DCA detections at SS9 & 14, and the increasing concentrations at soil leachate sample locations; evaluate whether groundwater sampling should include analysis of 1,4-dioxane; and investigate the potential presence of dioxin and determine if further action is necessary.

Environmental Indicators

- *Current human exposures at the Site are under control.*
- *Contaminated groundwater migration is under control.*

Are Necessary Institutional Controls in Place?

☐ All ☒ Some ☐ None

Has EPA Designated the Site as Sitewide Ready for Anticipated Use?

☐ Yes ☒ No

Has the Site Been Put into Reuse?
☐ Yes ☒ No

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1.0 Introduction

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. FYR reports document FYR methods, findings and conclusions. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121 states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The EPA interpreted this requirement further in the NCP, 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.

Skeo Solutions, an EPA Region 4 contractor, conducted the FYR and prepared this report regarding the remedy implemented at the Jadco-Hughes Facility Superfund site (the Site) in Belmont, Gaston County, North Carolina. The EPA's contractor conducted this FYR from December 2015 to September 2016. The EPA is the lead agency for developing and implementing the remedy for the potentially responsible party (PRP)-financed cleanup at the Site. The North Carolina Department of the Environment and Natural Resources (NCDENR), as the support agency representing the State of North Carolina, has reviewed all supporting documentation and provided input to the EPA during the FYR process.

This is the fourth FYR for the Site. The triggering action for this statutory review is the previous FYR. The FYR is required because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. The Site consists of one operable unit (OU).

2.0 Site Chronology

Table 1 lists the dates of important events for the Site.

Table 1: Chronology of Site Events

Event	Date
A solvent reclamation and waste storage facility operated on site	1969-1975
The State of North Carolina ordered the facility to close and called for the Site's cleanup under existing state and federal laws	1975
The State completed preliminary assessment and site inspection	June 1, 1980
PRP completed initial cleanup actions	1975-1983
The EPA completed expanded site inspection	May 23, 1984
The EPA proposed Site for inclusion on Superfund program's National Priorities List (NPL)	October 15, 1984
The EPA finalized Site on NPL	June 10, 1986
The EPA and PRP group entered into Administrative Order on Consent concerning remedial investigation and feasibility study (RI/FS)	September 1986
PRP group completed RI/FS and the EPA signed Site's Record of Decision (ROD)	September 27, 1990
The EPA completed Site's Human Health and Ecological Risk Assessment	September 28, 1990
PRP group completed removal action	March 15, 1991
The EPA issued Unilateral Administrative Order (UAO) to Jadco-Hughes Steering Committee (JHSC)	June 19, 1991
The EPA and PRP group entered into consent decree	March 18, 1994
The EPA completed Site's Remedial Design Report	September 23, 1994
The EPA issued Explanation of Significant Differences (ESD) for the Site's remedy	September 1994
PRP group began remedial action	June 20, 1995
The EPA completed Site's Preliminary Close-Out Report (PCOR)	December 30, 1996
The EPA completed Site's Remedial Action Report	May 29, 1997
The EPA completed Site's first FYR	September 25, 2001
PRP group submitted Reactive Material Pilot Study	November 12, 2001
PRP group requested permission to dismantle soil vapor extraction (SVE) system	May 28, 2003
NCDENR and the EPA approved dismantling request	June 1, 2003
PRP group requested permission from City of Mount Holly to remove carbon polisher from treatment system	July 3, 2003
City of Mount Holly approved request to remove carbon polisher	July 9 to August 4, 2003
PRP group completed removal of SVE system	May 14, 2004
PRP group submitted Large Scale Enhanced Bioremediation Pilot Study (LSEBPS)	June 8, 2004
The EPA and NCDENR approved LSEBPS	August 4, 2004
PRP group uncovered four drum skins and carcasses and found five buried drums	November 18, 2004
PRP group completed drum removal	February 5, 2005
The EPA completed Site's second FYR	September 27, 2006
PRP group completed former landfill data collection and evaluation activities work plan	May 1, 2008
PRP group completed containment analysis report and residential well survey	June 2008
The EPA completed analytical results for former landfill data collection and evaluation activities	October 3, 2008

Event	Date
The EPA completed analytical results for additional data collection activities summary	November 28, 2008
PRP group completed intermediate groundwater impacts investigation work plan	May 17, 2010
PRP group submitted work plan for modifying groundwater extraction system to the EPA	July 8, 2010
PRP group completed work plan to install four deep monitoring wells	October 3, 2010
PRP group signed Declaration of Perpetual Land Use Restrictions	July 20, 2011
The EPA completed Site's third FYR	September 29, 2011
PRP group initiated operation of two new extraction wells, PW5 and PW6, to contain intermediate and deep layer plume	March 2012
PRP group discontinued extraction wells PW1 through PW4	January 2013
PRP group completed bank stabilization and expansion of concrete culvert on east side of the Site	February 12, 2013
PRP group completed vapor intrusion assessment for residents north of the Site	May 7, 2013
PRP group updated Operation and Maintenance (O&M) Plan	November 2014
PRP group completed vertical extent assessment	November 18, 2014

3.0 Background

3.1 Physical Characteristics

The 6-acre Site is located on Cason Street in Belmont, Gaston County, North Carolina. The Site is fenced. It includes a groundwater treatment building, components of the groundwater treatment system in the northeastern part of the Site, an inactive soil vapor extraction (SVE) system and a capped landfill in the southwestern part of the Site, and a culvert in the eastern part of the Site (Figure 2). Cason Street and several businesses border the Site to the west. Residential areas border the Site to the north and east Wooded areas and an unnamed spring border the Site to the south..

Sources of contamination include spills that occurred during facility operations, two former in-ground pits where site operators placed solvents, and on-site storage of drums and tanks containing waste chemicals and sludge from area industries.

The Site is located within the Charlotte Granite Belt of the Piedmont Plateau, which lies between the Coastal Plain and the Appalachian Mountains. In general, the Site is relatively flat, sloping gently to the north. The site geology is predominantly weathered granite (saprolite) to a depth of 95 feet below ground surface (bgs), with fluvial deposits of clay, silt and sand in the saprolite at depths of 10 to 20 feet bgs. The water table is present at a depth of approximately 5 to 19 feet bgs with an average groundwater flow rate of 8 to 14 feet per year. The groundwater flows to the north. It is strongly influenced by groundwater discharge into the on-site culvert and tributaries to Fites Creek.

3.2 Land and Resource Use

From 1969 until 1975, a waste oil and solvent recovery and disposal facility operated on site. Since then, the Site has been inactive with no future use plans. Current land uses surrounding the Site are primarily residential and commercial. According to the Gaston County Development Office, there will be a cellular phone tower placed on a newly clear-cut area northeast of the Site. Catawba Heights Elementary School is located less than a mile from the Site to the east. Other than the installation of the cellular phone tower, future surrounding land uses are not expected to change.

The groundwater aquifer under the Site is not used as an on-site drinking water source, but is used by surrounding residents as a water supply resource. A small number of surrounding residents have operational drinking water wells that were installed before the City of Mount Holly installed municipal water supply lines in 1983.

3.3 History of Contamination

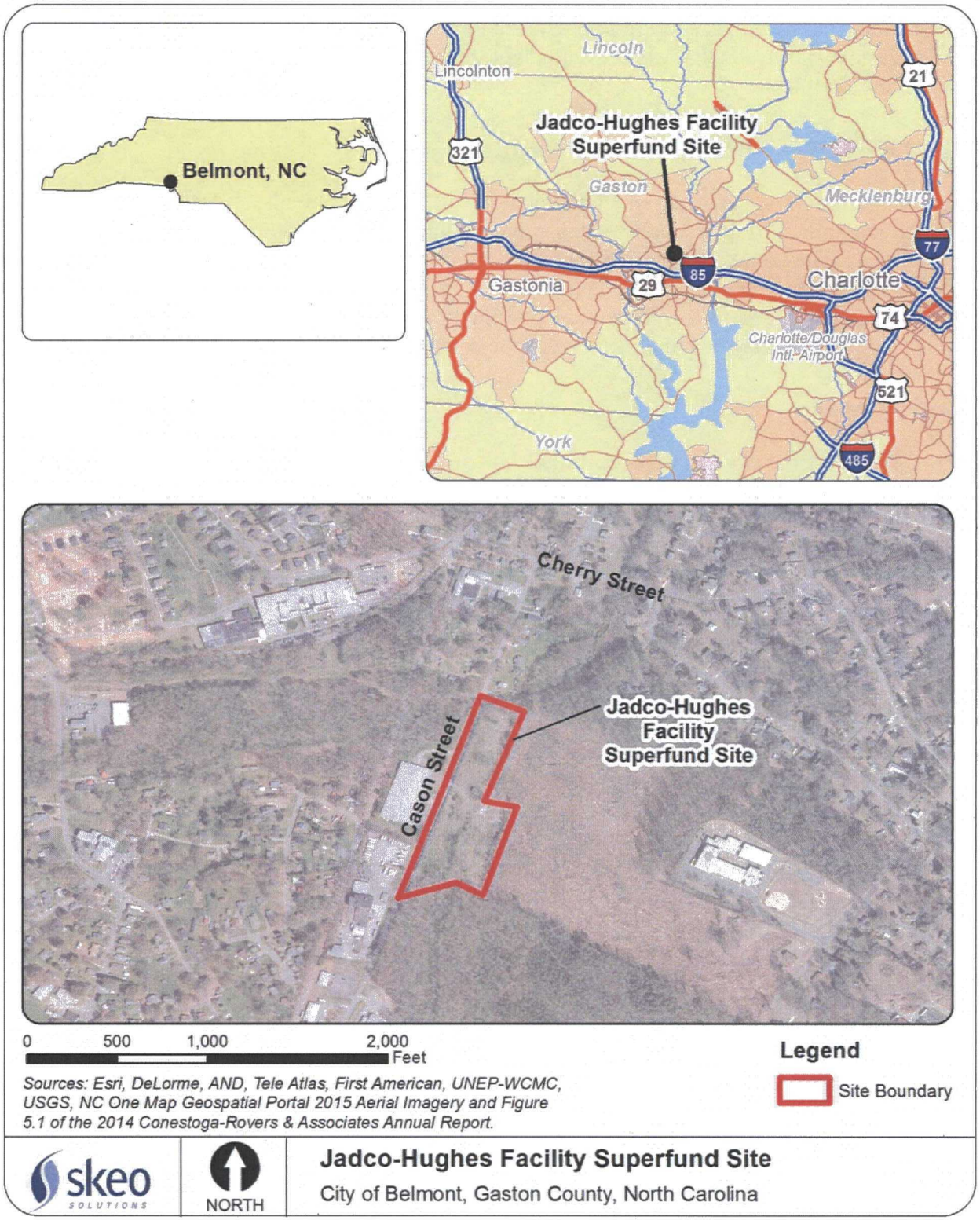
During facility operations, spills occurred, contaminating site soils, sediments, surface water and groundwater. Hazardous substances included ink solvents, lubricants, petroleum products and other unknown chemicals. The facility also stored drummed material consisting of waste chemicals and sludge from nearby industries, further contaminating the Site. In 1975, an estimated 8,000 to 10,000 drums were present on site. After complaints from nearby residents and documentation of frequent spills, the State of North Carolina ordered the Site's closure and cleanup.

3.4 Initial Response

Following the state-ordered cleanup declaration, the site owner completed several initial cleanup actions, ending in 1983. These actions included the excavation of two in-ground pits formerly used for solvent disposal and the consolidation of on-site contaminated surface soils into an on-site landfill. It also included the removal of all remaining large storage tanks, drums and a mobile tanker. Around this time, the EPA initiated a site investigation. The investigation analyzed surface water, sediment and groundwater samples. Based on investigation results, the EPA proposed the Site for listing on the Superfund program's National Priorities List (NPL) on October 15, 1984. EPA finalized the Site's listing on the NPL on June 10, 1986.

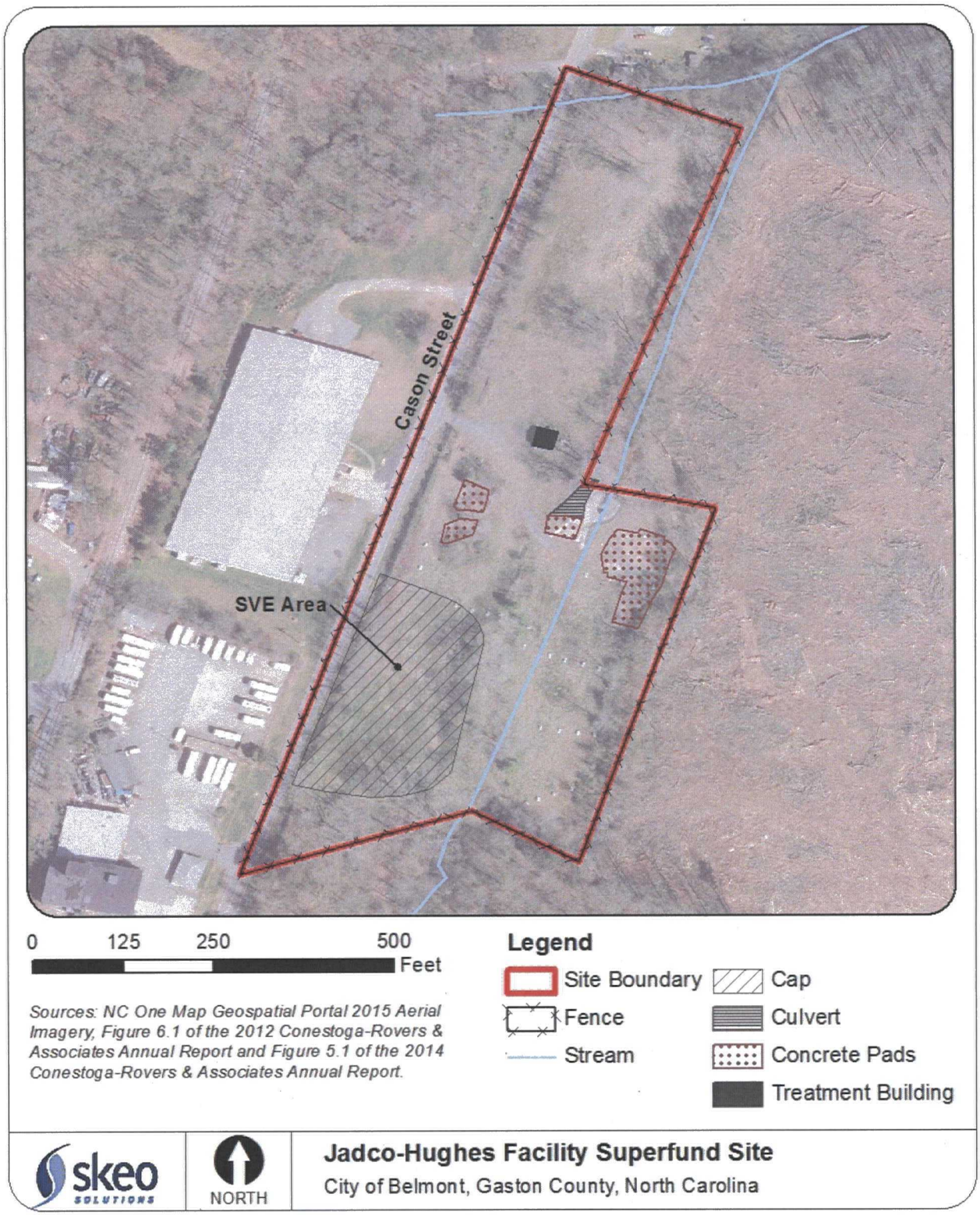
In September 1986, the EPA entered into an Administrative Order of Consent (AOC) with several companies identified as the Site's potentially responsible parties (PRPs). The AOC directed the PRPs to conduct the remedial investigation/feasibility study (RI/FS) at the Site. This group of companies subsequently formed the Jadco-Hughes Steering Committee (JHSC) to address the Site's cleanup and other actions. The JHSC group will subsequently be referred to as "the PRP group." The PRP group completed the RI/FS on September 27, 1990. During site investigation activities, the PRP group identified soils contaminated with polychlorinated biphenyls (PCBs). The group conducted an emergency removal action to excavate and dispose of 900 cubic yards of PCB-contaminated surface soils from the southeast swale area. The action was completed in March 1991.

Figure 1: Site Location Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site.

Figure 2: Detailed Site Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site

3.5 Basis for Taking Action

The RI/FS identified the primary contaminants of concern (COCs) affecting soil, groundwater, and surface water. They included VOCs – benzene, PCE, TCE, toluene and xylenes – other organics, including PCBs and phenols, and metals, including arsenic, chromium and lead. The PRP group also conducted a baseline risk assessment during the RI/FS process. Exposure assumptions in the risk assessment included pathways to soil, air, groundwater and surface water. The assessment identified the major pathway for exposure as contaminated groundwater. Specifically, it concluded there was the potential for downgradient groundwater users to be exposed to indicator chemicals above the acceptable level for carcinogenic and non-carcinogenic risk. Contaminated soils that remained on site were considered a direct contact threat to potential trespassers and a continual source of contamination to groundwater.

4.0 Remedial Actions

In accordance with CERCLA and the NCP, the overriding goals for any remedial action are protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs). A number of remedial alternatives were considered for the Site, and final selection was made based on an evaluation of each alternative against nine evaluation criteria that are specified in Section 300.430(e)(9)(iii) of the NCP. The nine criteria are:

1. Overall Protection of Human Health and the Environment
2. Compliance with ARARs
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility or Volume through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

4.1 Remedy Selection

The EPA selected a remedy to address soil, sediment and groundwater cleanup in the Site's September 1990 ROD. The only remedial action objective (RAO) stated in the 1990 ROD was to restore groundwater to its beneficial use as a potential drinking water source.

The Site's ROD selected excavation and capping, SVE and soil flushing to address contaminated soils. Table 2 contains remediation goals for soil contamination, which were designed to eliminate leachability of soil contamination that would exceed groundwater cleanup goals. The ROD selected a groundwater extraction and treatment system for discharge to Belmont Township's publicly owned treatment works (POTW) to address contaminated groundwater. Tables 3 and 4 identify groundwater contamination remedial goals. The selected remedy also included:

- Deed restrictions in the form of institutional controls on the use of the property and the use of groundwater beneath the Site.
- Access restrictions in the form of a security fence to minimize unauthorized access.

- Monitoring in the form of periodic measurements of groundwater and surface water quality to assess any changes and trends of contamination.
- On-site culvert replacement to prevent contaminated groundwater discharge to the nearby tributary.

In September 1994, the EPA signed an Explanation of Significant Differences (ESD), which required sampling of soil leachate after completion of soil remediation. Testing of leachate would determine the soil remedy's protectiveness of groundwater. The ESD specifically called for the sampling of landfill soil leachate, in the form of the captured flushing water, to be compared with the groundwater remedial goals in the 1990 ROD (Tables 3 and 4). If the soil leachate sampling results met groundwater remedial goals, on-site soil would no longer be considered a source of unacceptable risk to human health and the environment.

Table 2: Soil COC Remediation Goals

Soil COC	ROD Cleanup Goal (mg/kg)
Arsenic[A]	48
Barium	360
Cadmium	6
Carbon tetrachloride	3.689
Chloroform	15.865
Chromium[A]	140
1,2-Dichlorobenzene[A]	1.5
Lead	1.3
Mercury	0.15
PCBs	10
Selenium[A]	4.6
Silver[A]	0.6
Vinyl chloride	0.014
Notes: Data source: 1990 ROD, Table 14 [A] Based on the established background soil concentration as established by the RI. mg/kg = milligram per kilogram	

Table 3: Groundwater Organic COC Remediation Goals

Groundwater Organic COC	ROD Cleanup Goal (µg/L)
Acetone	700
Benzene	1
Benzoic acid	28,000
Bis(2-chloroethyl) ether	0.03
Bis(2-ethylhexyl)phthalate	4

Groundwater Organic COC	ROD Cleanup Goal (µg/L)
2-Butanone	170
Carbon tetrachloride	0.3
Chlorobenzene	300
Chloroethane	10
Chloroform	0.19
1,2-Dichlorobenzene	620
1,3-Dichlorobenzene	620
1,4-Dichlorobenzene	1.8
1,1-Dichloroethane	0.3
1,2-Dichloroethane	0.3
1,1-Dichloroethylene	7
1,2-Dichloroehtylene (total)	70
1,2-Dichloropropane	0.56
Di-n-butyl Phthalate	700
Ethyl benzene	29
2-Hexanone	10
Methylene chloride	5
4-Methyl-2-Pentanone	350
Phenol	4,200
Tetrachloroethylene	0.7
Toluene	1,000
1,2,4-Trichlorobenzene	9
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	3
Trichloroethylene	2.8
Vinyl chloride	0.015
Xylene	400
Notes: Data source: 1990 ROD, Table 13 µg/kg = microgram per kilogram	

Table 4: Groundwater Inorganic COC Remediation Goals

Groundwater Inorganic COC	ROD Cleanup Goal (µg/L)
Aluminum	50
Antimony	3
Arsenic	50
Barium	1,000

Groundwater Inorganic COC	ROD Cleanup Goal (µg/L)
Beryllium	1
Cadmium	5
Chromium	50
Iron	300
Lead	15
Manganese	150
Nickel	150
Vanadium	20
Zinc	5,000
Notes: Data source: 1990 ROD, Table 13	

4.2 Remedy Implementation

After issuing the Site's ROD in 1990, the EPA issued a Unilateral Administrative Order (UAO) to the PRP group on June 19, 1991. Accompanying the order, the EPA also issued a Scope of Work for the remedial design and remedial action. The PRP group contracted Conestoga-Rovers & Associates (CRA) to perform the remedial design and remedial action. CRA began the remedial design process in August 1991 and completed the remedial design in April 1993. The EPA approved the final remedial design work plan on September 23, 1994.

CRA began the construction of remedial action components on January 8, 1996, and completed all remedial action activities on August 7, 1996. Below is a summary of the activities completed:

- Construction of the groundwater extraction system.
- Construction of the groundwater treatment system.
- Construction of the SVE system.
- Development of a work area for installation of the soil flushing system.
- Construction of the soil flushing system.
- Construction of the culvert sliplining.
- Excavation of 500 cubic yards of contaminated soils along the east side of the concrete pad of the former operations area.
- Transportation and placement of excavated soils in the former landfill area.
- Construction of the landfill cap (1.3-foot-thick clean soil cover).
- Construction of fencing around the Site.

On August 7, 1996, the EPA and NCDENR conducted the final remedial action site inspection. The EPA and NCDENR subsequently approved operation of the remedial components on April 29, 1997.

The PRP group operated the SVE system until the end of 2000 and received approval from the EPA and the City of Mount Holly for its decommissioning on June 1, 2003. The concentrations of VOCs in the influent vapor to the SVE system had declined and were essentially non-detects. The PRP group completed removal of the SVE system on May 14, 2004.

In 2001, the PRP group proposed the use of natural soil flushing in place of the active soil flushing system already in place. The EPA approved this request and the natural soil flushing collection system began operating in October 2001. On November 18, 2004, the PRP group uncovered four drum skins and carcasses and five buried drums. The PRP group subsequently removed these drums on February 5, 2005. The PRP group completed a door-to-door review of 13 nearby private wells to verify information and to determine status of the water supply wells identified during the 1989 RI survey.

The groundwater extraction and treatment system mostly operates as intended by the 1990 ROD. Monitoring data from the 2011 FYR period demonstrated contamination outside the primary capture area of the existing containment system, both in deeper parts of the saprolite and downgradient of the perimeter collection system. Between November 2011 and March 2012, the PRP group modified the extraction system by connecting two deep extraction wells (PW5 and PW6) to contain deep groundwater impacts at the north end of the Site. Monitoring of contaminant concentrations still occurs as specified by the ROD. The PRP group implemented institutional controls in 2011 in the form of a Declaration of Perpetual Land Use Restrictions, restricting use of site groundwater, allowing only commercial and industrial uses on site property and prohibiting disturbance of current engineering controls. As specified in the 1994 ESD, soil leachate sampling occurs annually.

4.3 Operation and Maintenance (O&M)

In accordance with the requirements of the 2014 Operation and Maintenance Plan, the PRP group submits annual site summary status reports concerning O&M and monitoring activities to the EPA and NCDENR. Primary O&M activities include:

- Weekly, quarterly and semi-annual inspections, as specified in the O&M plan. The inspections include inspections and maintenance of site security and signage, the groundwater treatment system building, the soil flushing system, the former landfill area and the concrete spillway and slip-lined culvert.
- Monitoring of the groundwater extraction system and the system's hydraulic containment through annual hydraulic (water level) sampling of the extraction wells, monitoring wells, piezometers and manholes.
- Monitoring of contaminant concentrations in the shallow, intermediate and deep groundwater below the Site through annual and semi-annual sampling of monitoring wells for VOCs, base neutral and acids (BNAs), PCBs and various metals (nickel, lead, chromium, cadmium and arsenic) as specified in the plan.
- Annual influent and effluent water sampling to further assess the effectiveness of the treatment system, including analysis of VOCs, BNAs, PCBs, various metals, oil and grease, and general chemistry parameters.

The original 1997 O&M plan included SVE system O&M activities. Since removal of the SVE system in 2004, SVE system O&M activities were deleted from the 2014 O&M plan. In March 2012, the PRP group began operating two new extraction wells – PW5 and PW6 – at the north end of the Site. In early 2013, it appeared the bank near the discharge outlet of the culvert had eroded. As a result, the PRP group reconstructed the erosion control system, expanding the existing culvert and stabilizing the bank. The PRP group also discontinued operation of extraction wells PW1 through PW4 in 2013 due to operational inefficiencies and redundancy. From August to November 2015, the groundwater extraction system was not operational due to equipment malfunctions; it is now operational again.

The 1990 FS Report stated that the present worth O&M costs would be $2,665,600 over 30 years of operation and 30 years of groundwater monitoring, or $88,853.33 per year. During this FYR period, CRA estimated O&M costs to be about $2.5 million total, or $500,000 per year. This total is about $1 million greater than costs during the previous FYR period. Reasons for the increased O&M costs include modifications to the groundwater extraction system, expansion of the culvert and small equipment malfunctions, which are detailed in the annual reports.

5.0 Progress Since the Last Five-Year Review

The protectiveness statement from the 2011 FYR for the Site stated:

"The remedy at the Jadco-Hughes Site is currently protective of human health and the environment in the short-term because 1) source soil contamination was remediated through removals and treatment of soils through soil vapor extraction and soil flushing, and 2) groundwater contamination is currently being remediated by extraction and treatment. Currently no human exposure pathways exist to contaminated soil or groundwater. Institutional Controls (ICs) have been fully implemented at the Site and a Declaration of Perpetual Land Use Restrictions has been signed. The groundwater contamination was originally believed to be primarily shallow, which the remediation system was designed to contain. However, in more recent monitoring periods, evidence of contamination in the intermediate and deep aquifers has been reported. The JHSC has been actively investigating the groundwater plume and has modified the groundwater extraction system to prevent additional contaminant migration. In order for the remedies to be protective in the long-term, the following actions need to be taken: confirm that the modification to the groundwater treatment system is adequately preventing additional contaminant migration and develop a plan to address the groundwater contaminant that is down gradient of the collection system."

The 2011 FYR included five issues and recommendations. This report summarizes each recommendation and its current status below.

Table 5: Progress on Recommendations from the 2011 FYR

Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Determine if the changes in the NC 2L will require changes to the remedial goals set in the ROD.[1]	EPA and State of North Carolina	09/30/2013	Ongoing – the EPA will reevaluate once groundwater conditions are nearing current remedial goals.	Ongoing
Evaluate the modification to the extraction system to ensure that it will address the contaminant migration issue.	EPA and State of North Carolina	09/30/2013	PRP group evaluated contaminant migration issue in the North Boundary Containment Analysis Report and noted decreasing groundwater contamination concentrations off site.	08/2012
Sampling of soil leachate from the landfill needs to continue on a regular basis.	JHSC	09/30/2013	PRP group samples leachate annually.	12/2012
Develop a plan to address groundwater contamination downgradient of the collection system.	JHSC	09/30/2013	PRP group developed and implemented the plan involving modifying the existing groundwater extraction system to include two new deep-layer extraction wells.	04/26/2013

Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
To aid in the overall assessment of the Site, reports submitted by the PRP group shall include trend analysis, plume containment maps, isoconcentration maps, volume of groundwater treated and volume of contaminants removed by the remediation system in the annual reports.	JHSC	12/31/2011	PRP group implemented trend analyses, plume containment maps, iso-concentration maps, volume of groundwater treated and volume of contaminants removed into the 2011 Annual Report and all subsequent annual reports.	04/2012
[1] North Carolina state groundwater standard maximum contaminant levels (MCLs).				

6.0 Five-Year Review Process

6.1 Administrative Components

EPA Region 4 initiated the FYR in December 2015 and scheduled its completion for September 2016. The EPA remedial project manager (RPM) Michael Townsend led the EPA site review team, which also included the EPA site attorney Caroline Philson, the EPA community involvement coordinator (CIC) Angela Miller and contractor support provided to the EPA by Skeo Solutions. The review schedule established consisted of the following activities:

- Community notification.
- Document review.
- Data collection and review.
- Site inspection.
- Local interviews.
- FYR Report development and review.

6.2 Community Involvement

In September 2016, the EPA published a public notice in the Gaston Gazette newspaper announcing the FYR process for the Site, providing contact information for Michael Townsend and Angela Miller, inviting community participation. The press notice is available in Appendix B.

The EPA will make the final FYR Report available to the public. Upon completion of the FYR, the EPA will place copies of the document in the designated site repository: the main branch of the Gaston County Public Library, located at 1555 East Garrison Boulevard in Gastonia, North Carolina 28054.

6.3 Document Review

This FYR included a review of relevant site-related documents, including the ROD, the ESD, remedial action reports and recent monitoring data. Appendix A provides a complete list of the documents reviewed.

ARARs Review

CERCLA Section 121(d)(1) requires that Superfund remedial actions attain "a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." The remedial action must achieve a level of cleanup that at least attains those requirements that are legally applicable or relevant and appropriate.

- Applicable requirements are those cleanup standards, standards of control and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, remedial action, location or other circumstance found at a CERCLA site.

- Relevant and appropriate requirements are those standards that, while not "applicable," address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards more stringent than federal requirements may be applicable or relevant and appropriate.

- To-Be-Considered criteria are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary remedial action. For example, To-Be-Considered criteria may be particularly useful in determining health-based levels where no ARARs exist or in developing the appropriate method for conducting a remedial action.

Chemical-specific ARARs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish an acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. Examples of chemical-specific ARARs include maximum contaminant levels (MCLs) under the federal Safe Drinking Water Act and ambient water quality criteria enumerated under the federal Clean Water Act.

Action-specific ARARs are technology- or activity-based requirements or limits on actions taken with respect to a particular hazardous substance. These requirements are triggered by a particular remedial activity, such as discharge of contaminated groundwater or in-situ remediation.

Location-specific ARARs are restrictions on hazardous substances or the conduct of the response activities solely based on their location in a special geographic area. Examples include restrictions on activities in wetlands, sensitive habitats and historic places.

Remedial actions are required to comply with the chemical-specific ARARs identified in the ROD. In performing the FYR for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed. Because the remedy at the Site addresses only groundwater contamination, this FYR will discuss chemical-specific and health-based groundwater ARARs only.

Groundwater

According to the 1990 ROD, groundwater ARARs include the federal Safe Drinking Water Act (40 USC Section 300; 40 CFR Part 141, 143) and the North Carolina Drinking Water and Groundwater

Standards (NCAC Title 15A Chapter 2L), referred to later as NC 2L. For those contaminants that did not have federal or state standards, the ROD selected health-based remedial goals.

The 1990 ROD adopted NC 2L Groundwater Standards for 28 of the 45 COCs. However, since the signing of the ROD in 1990, the State of North Carolina amended these standards, effective April 1, 2013. The organic compounds chlorobenzene, toluene, bis(2-ethylhexyl) phthalate, 1,2-dichlorobenzene, 1,3-dichlorobenzene and phenol have remedial goals that are less stringent than these new standards (Table 6). The inorganic compounds arsenic, barium, cadmium, chromium, manganese, nickel and zinc have remedial goals that are less stringent than the standards (Table 7). All COCs have remedial goals at or below federal MCLs for each compound, with the exception of chlorobenzene, 1,3-dichlorobenzene, arsenic and manganese.

Table 6: Previous and 2016 ARARs for Organic Groundwater COCs

COC	1990 ROD Cleanup Goal (µg/L)[a]	Current NC 2L Groundwater Standards (as of April 1, 2013) (µg/L)[b]	Current Federal MCLs (µg/L)[c]	ARAR Change
Acetone	700	6,000	-	Yes - less stringent
Benzene	1	1	5	No
Benzoic acid	28,000	30,000	-	No
Bis(2-chloroethyl) ether	0.03	0.03	-	Yes- less stringent
Bis(2-ethylhexyl)phthalate	4	**3**	-	Yes- more stringent
2-Butanone	170	4,000	-	Yes- less stringent
Carbon tetrachloride	0.3	0.3	5	No
Chlorobenzene	300	**50**	**100**	Yes- more stringent
Chloroethane	10	3,000	-	Yes- less stringent
Chloroform	0.19	70	70	Yes- less stringent
1,2-Dichlorobenzene	620	**20**	-	Yes- more stringent
1,3-Dichlorobenzene	620	**200**	**600**	Yes- more stringent
1,4-Dichlorobenzene	1.8	6	75	Yes- less stringent
1,1-Dichloroethane	0.3	6	-	Yes- less stringent
1,2-Dichloroethane	0.3	0.4	5	Yes- less stringent
1,1-Dichloroethylene	7	7	7	No
1,2-Dichloroethylene	70	-	70	No
1,2-Dichloropropane	0.56	0.6	5	Yes- less stringent
Di-n-butyl phthalate	700	700	-	No
Ethylbenzene	29	600	700	Yes- less stringent
2-Hexanone	10	-	-	No
Methylene chloride	5	5	5	No
4-Methyl-2-Pentanone	350	-	-	No
Phenol	4,200	**30**	-	Yes- more stringent
Tetrachloroethylene	0.7	0.7	5	No
Toluene	1,000	**600**	1,000	Yes- more stringent
1,2,4-Trichlorobenzene	9	70	70	Yes- less stringent
1,1,1-Trichloroethane	200	200	200	No
1,1,2-Trichloroethane	3	-	5	Yes- less stringent
Trichloroethylene	2.8	3	5	Yes- less stringent
Vinyl chloride	0.015	0.03	2	Yes- less stringent
Xylene	400	500	10,000	Yes- less stringent

COC	1990 ROD Cleanup Goal (µg/L)[a]	Current NC 2L Groundwater Standards (as of April 1, 2013) (µg/L)[b]	Current Federal MCLs (µg/L)[c]	ARAR Change
Notes: a. 1990 ROD, Table 13. b. NC 2L MCLs are available at http://portal.ncdenr.org/web/wq/ps/csu/gwstandards (accessed 02/04/2016). c. Current federal MCLs are available at http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants (accessed 2/4/2016). **Bolded** = state or federal ARAR more stringent than current remedial goal.				

Table 7: Previous and 2016 ARARs for Inorganic Groundwater COCs

COC	1990 ROD Cleanup Goal (µg/L)[a]	2015 ARAR (µg/L)[b]	Current Federal MCLs (µg/L)[c]	ARAR Change
Aluminum	50	-	-	No
Antimony	3	-	6	Yes- less stringent
Arsenic	50	**10**	**10**	Yes- more stringent
Barium	1,000	**700**	2,000	Yes- more stringent
Beryllium	1	-	4	Yes- less stringent
Cadmium	5	**2**	5	Yes- more stringent
Chromium	50	**10**	100	Yes- more stringent
Iron	300	300	-	No
Lead	15	15	15	No
Manganese	150	**50**	**50**	Yes- more stringent
Nickel	150	**100**	-	Yes- more stringent
Vanadium	20	-	-	No
Zinc	5,000	**1,000**	-	Yes- more stringent
Notes: a. 1990 ROD, Table 13. b. NC 2L MCLs are available at http://portal.ncdenr.org/web/wq/ps/csu/gwstandards (accessed 02/04/2016). c. Current federal MCLs are available at http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants (accessed 2/4/2016). bolded = state or federal ARAR more stringent than current remedial goal.				

Institutional Control Review

On January 14, 2016, contractor staff conducted research using the Gaston County Public Records website and found the deed information pertaining to the Site listed in Table 8.

Table 8: Deed Documents from Gaston County Public Records Website

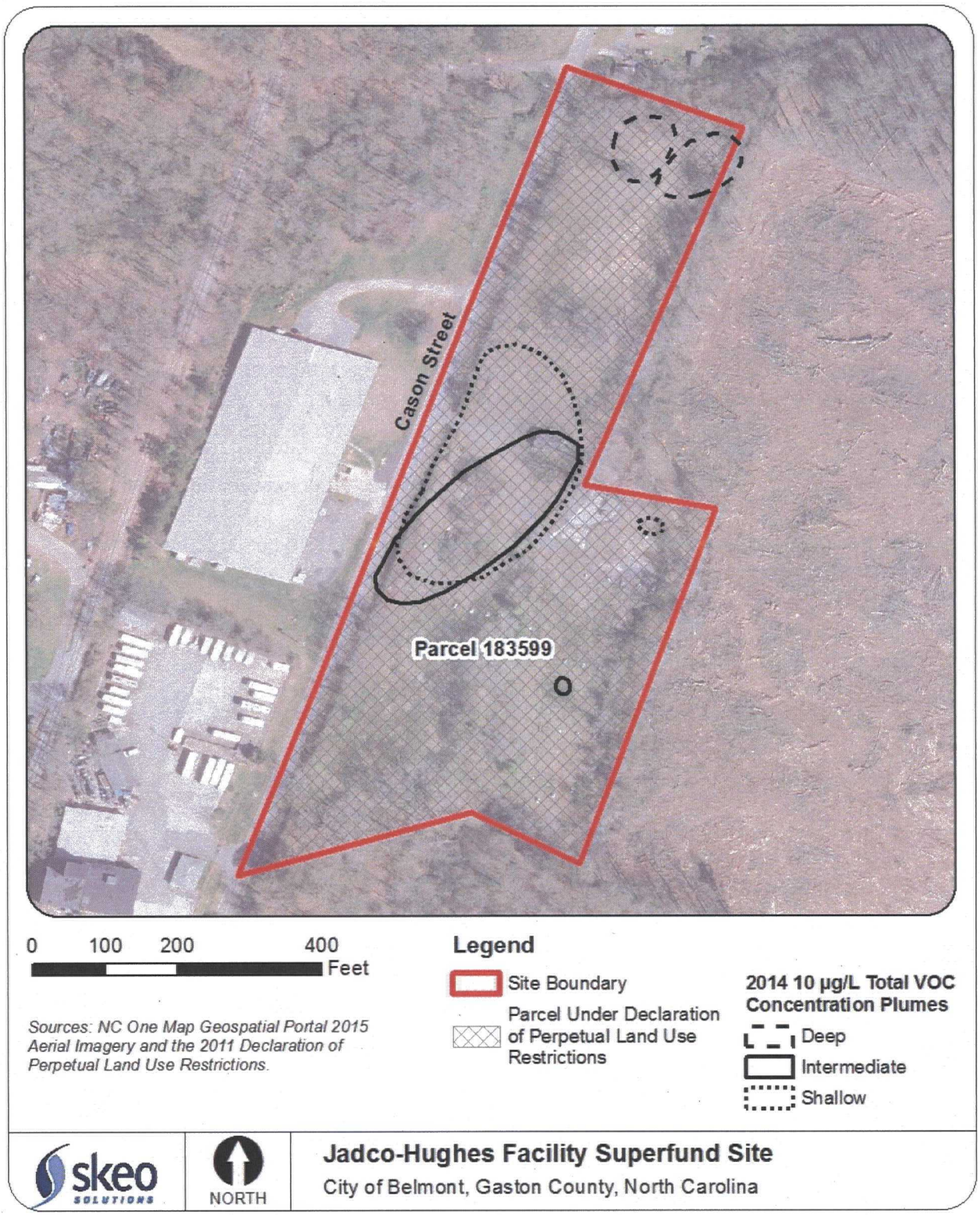
Date	Type of Document	Description	Book #	Page #
07/20/2011	Declaration of Perpetual Land Use Restrictions	Designates future land use restrictions, including no use of site groundwater; the Site can only be used for commercial and industrial purposes and all engineering controls shall be maintained.	4580	789
Source: Gaston County Register of Deeds Office, accessed 12/14/2015. https://deeds.co.gaston.nc.us/external/LandRecords/protected/v4/SrchName.aspx.				

Table 9 lists the institutional control associated with the Declaration of Perpetual Land Use Restrictions (Declaration) between the PRP group and NCDENR, with the EPA as a third party beneficiary of the Declaration (Figure 3). These include prohibition of groundwater use beneath the boundaries of the property except for operation of the remediation systems on site; prohibition of site uses for any purpose except for industrial or commercial purposes; and maintenance of current on-site engineering controls with no disturbances. The document establishes that these restrictions shall continue in perpetuity and can only be amended or canceled if the secretary of the NCDENR records a written concurrence.

Table 9: Institutional Control (IC) Summary Table

Media	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Instrument in Place	Notes
Groundwater, Soils	Yes	Yes	183599	Restrict site groundwater use for any purpose except for the operation of the remediation systems on site, restrict future land uses to industrial or commercial purposes only, and maintain current engineering controls on site with no disturbances.	Declaration of Perpetual Land Use Restrictions	Document signed by the PRP group on July 20, 2011
Source: Gaston County Register of Deeds Office, accessed 12/14/2015. https://deeds.co.gaston.nc.us/external/LandRecords/protected/v4/SrchName.aspx.						

Figure 3: Institutional Control Base Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site.

6.4 Data Review

This data review incorporates groundwater, surface water and sediment sampling data collected between 2011 and 2015 and presented in annual and quarterly monitoring reports. Figure 2 depicts sampling locations. Appendix F provides plume maps, groundwater elevation maps and other supporting documentation from the 2014 Annual Report.

Key findings from this data review are provided below:

- Groundwater data collected from the shallow, intermediate and deep monitoring wells installed in saprolite at the Site continue to report VOCs above remedial goals. In general, VOC concentrations were lower in 2013 and 2014 compared to prior years.
- The perimeter collection system in combination with the deep extraction well system is effectively containing the shallow groundwater plume within the property boundaries.
- Operation of new deep extraction wells PW5 and PW6 is having a positive effect on intermediate zone contamination. The majority of the plume is contained and VOC concentrations are generally decreasing. However, downgradient well MW12D has reported increasing concentrations of total VOCs since 2013. Adjustments to the pumping rate at PW5 may be the cause of the increase. Additional action may be necessary to limit further migration of contamination off property and to define the current extent of contamination downgradient of MW12D.
- Extraction wells PW5 and PW6 appear to provide containment of the deep groundwater contamination at the northern property boundary.
- Concentrations of 1,2-dichloroethane (1,2-DCA) continue to be detected in surface water at SS9 and SS14, located in Tributary B. Additional action may be necessary to address the cause of this contamination.
- Site-related VOCs were not detected in sediment with the exception of a single occurrence of 1,2-DCA at sample location SS9 in 2013.

Groundwater

Monitoring wells at the Site are installed within the saprolite unit at three depth intervals (shallow (S), intermediate (D) and deep (DD)). This FYR evaluates the data with respect to the shallow, intermediate and deep units.

Shallow Unit

Six shallow unit wells (MW3S, MW6S, MW6SD, MW7S, MW21S and MW22S) reported COCs above remedial goals during this FYR period (2011 through 2014, see Table 10). Most remedial goal exceedances occurred in wells MW6S and MW6SD, located in the eastern part of the site. None of the maximum detected concentrations occurred in 2014.

Table 10: Shallow Groundwater COC Summary

COC[a]	Remediation Goal (µg/l)	Maximum Detected Concentration[b] (µg/l)	Location of Maximum Detected Concentration (date)	Number of Wells with Detections above Remediation Goal
1,2-Dichloroethane (1,2-DCA)	0.3	110	MW6SD (2011)	3

COC[a]	Remediation Goal (µg/l)	Maximum Detected Concentration[b] (µg/l)	Location of Maximum Detected Concentration (date)	Number of Wells with Detections above Remediation Goal
1,4-Dichlorobenzene	1.8	82	MW21S (2013)	4
2-Hexanone	10	14	MW6S (2012)	1
Acetone	700	1,500	MW6SD (2011)	2
Benzene	1	5.8	MW6SD (2013)	2
Bis(2-chloroethyl)ether	0.03	140	MW6S (2013)	1
Carbon tetrachloride	0.3	21,000	MW7S (2013)	2
Chloroethane	10	21	MW6SD (2013)	2
Chloroform	0.19	1,300	MW3S (2012)	2
Cis-1,2-dichloroethene (DCE)	70	2,200	MW6SD (2012)	2
Trans-1,2-DCE	70	83	MW6SD (2012)	1
Trichloroethene (TCE)	2.8	29	MW3S (2012)	1
Vinyl chloride	0.015	730	MW6SD (2012)	2

Notes:
a) Only those COCs with at least one detection above the remedial goal are included in this table.
b) Maximum detected concentration between December 2011 and December 2014.
Source: 2011-2014 Annual Report

Figure 6.1 in Appendix F presents an isoconcentration map of total VOC concentrations for the shallow groundwater unit in 2014. As shown in Figure 6.1, shallow groundwater contamination remains largely within the property boundary, with well MW7S reporting the highest total VOC concentrations in 2014 (16,390 micrograms per liter, or µg/L). Carbon tetrachloride at 16,000 µg/L contributed the most to the total VOC concentration at MW7S. Results of a Mann-Kendall trend analysis and graph of detected concentrations over time (Appendix F) show that carbon tetrachloride has increased at MW7S since system startup. MW7S is in the flowpath between well MW3S, which historically reported elevated levels of carbon tetrachloride, and the shallow groundwater collection system. Based on groundwater elevation contours (presented in Appendix F), groundwater from MW7S appears to be captured by the perimeter collection system.

A second area of shallow groundwater contamination (with vinyl chloride, 1,2-dichloroethane, 1,4-dichlorobenzene and benzene above remediation goals) is located in the eastern portion of the Site in the vicinity of wells MW6S and MW6SD. Mann Kendall trend analyses for these wells did not identify increasing trends for any COCs detected above remedial goals. In addition, sentry well MW9S, located immediately downgradient of these wells, did not report VOCs above remedial goals in 2014. The perimeter collection system in combination with the deep extraction well system is effectively containing the shallow groundwater plume within site property boundaries.

A review of groundwater data also identified detection limits for semi-volatile organic compounds (SVOCs) – (bis(2-chloroethylether) and bis(2-ethylhexyl)phthalate) – above remedial goals. Analytical methods may need re-evaluation to ensure they can meet remedial goals.

Intermediate Unit (D wells)
Of the nine intermediate unit wells currently monitored, six wells (MW2D, MW3D, MW5D, MW7D, MW12D and MW23D) reported COCs above remedial goals during this FYR period. Chloroform was the most prevalent COC, detected above remedial goals in six of the nine wells. Table 11 summarizes COCs that exceeded remedial goals during this FYR period. None of the maximum detected concentrations occurred in 2014. Only one maximum detected concentration occurred in 2013. Pumping

of the new deep extraction wells appears to be having a positive effect on intermediate zone contamination. Overall, COC concentrations have decreased since 2011 (with an exception at MW12D, discussed below).

Table 11: Intermediate Groundwater COC Summary

COC[a]	Remediation Goal (µg/l)	Maximum Detected Concentration[b] (µg/l)	Location of Maximum Detected Concentration (date)	Number of Wells with Detections above Remediation Goal
1,1-DCA	0.3	120	MW3D (2012)	4
1,2-DCA	0.3	1,100	MW3D (2012)	4
1,1-Dichloroethene	7	8.7	MW7D (2011)	1
1,2-Dichloropropane	0.56	1.6	MW7D (2011)	1
1,2,4-Trichlorobenzene	9	56J[c]	MW2D (2011)	1
1,4-Dichlorobenzene	1.8	510	MW2D (2011)	1
Benzene	1	76	MW3D (2012)	3
Bis(2-chloroethyl)ether	0.03	1,500	MW2D (2011)	2
Carbon tetrachloride	0.3	1,800	MW3D (2012)	4
Chlorobenzene	300	3,100	MW2D (2011)	1
Chloroform	0.19	710	MW3D (2013)	6
Cis-1,2-dichloroethene (cis-1,2-DCE)	70	200	MW3D (2012)	1
Methylene chloride	5	1,900	MW3D (2011)	1
TCE	2.8	320	MW3D (2012)	5
Tetrachloroethene (PCE)	0.7	43	MW7D (2011)	4
Vinyl chloride	0.015	15J[c]	MW2D (2011)	2

Notes:
a) Only those COCs with at least one detection above remedial goals are included in this table.
b) Maximum detected concentration between December 2011 and December 2014.
c) "J" indicates estimated values detected between the lab quantitation limit and detection limit.
Source: 2011-2014 Annual Report

Figure 6.2 in Appendix F presents an isoconcentration map of 2014 total VOC concentrations for the intermediate groundwater unit. As shown in Figure 6.2, intermediate groundwater contamination is concentrated in the area of wells MW3D and MW7D with a smaller area of contamination at MW2D. Figure 6.2 also shows total VOCs at about 75 µg/L at off-property sentry well MW12D.

VOC concentrations in MW12D increased in 2014 when compared to the concentrations in the 2013 samples (see Appendix F time-concentration graph of TCE in MW12D). The 2014 Annual Report states that the increase in concentrations may be a result of decreasing the pumping rate at PW5 to 8 gallons per minute (gpm) in December 2013 in an effort to optimize the groundwater extraction system. As a result of the increase in VOCs in MW12D, the pumping rate at PW5 was again increased to 10 gpm in April 2014.

Preliminary results from 2015 presented in the Quarterly Progress Report – July through September 2015, show that total VOC concentrations in MW12D remain elevated (178.8 µg/L in June 2015, 127.3 µg/L in July 2015 and 126.8 µg/L in September 2015). The well may potentially be located within the stagnation zone of the deep extraction well system. Sampling should continue in order to evaluate the effects of the increased pumping rate on MW12D and to determine if additional efforts are necessary to contain the plume. The PRP group should also consider delineating the extent of contamination in the

intermediate zone downgradient of MW12D. Some contamination may have migrated beyond the currently identified extent prior to bringing the two deep extraction wells online in 2012.

Deep Unit (DD wells)
Four (MW5DDR, MW24DD, MW27DD and MW28DD) of the five deep wells reported COCs above remedial goals during this FYR period. Table 12 summarizes COCs that exceeded remedial goals during this FYR period in the deep wells. All of the maximum detected concentrations occurred in 2012 or 2013. The two deep extraction wells (PW5 and PW6), brought online in 2012, appear to provide containment of the deep groundwater contamination at the northern property boundary.

Table 12: Deep Groundwater COC Summary

COC[a]	Remediation Goal (µg/l)	Maximum Detected Concentration[b] (µg/l)	Location of Maximum Detected Concentration (date)	Number of Wells with Detections above Remediation Goal
1,1-DCA	0.3	5.4[c]	MW24DD(2013)	3
1,2-DCA	0.3	11	MW28DD (2011)	2
Carbon tetrachloride	0.3	11	MW28DD (2011)	2
Chloroform	0.19	56	MW28DD (2011)	4
Cis-1,2-DCE	70	2,100	MW5DDR (2011)	2
Methylene chloride	5	6.8	MW24DD (2012)	1
PCE	0.7	33J[d]	MW28DD (2011)	4
TCE	2.8	600	MW28DD (2011)	2

Notes:
a) Only those COCs with at least one detection above remedial goals are included in this table.
b) Maximum detected concentration between March 2011 and December 2014.
c) Results from a duplicate sample. Primary sampled reported 3.9 µg/L.
d) "J" indicates estimated values detected between the lab quantitation limit and detection limit.
Source: 2011-2014 Annual Report

Figure 6.3 in Appendix F presents an isoconcentration map of 2014 total VOC concentrations for the deep groundwater unit. As shown in Figure 6.3, deep groundwater contamination is concentrated in the area of northern extraction wells PW5 and PW6.

The Mann-Kendall trend tests for the deep wells identified an increasing trend for cis-1,2-dichloroethene (cis-1,2-DCE) at MW5DDR. All other deep wells reported either no trends or decreasing trends. The 2014 concentration of cis-1,2-DCE in MW5DDR was 2.9 µg/L, well below its remedial goal of 70 µg/L.

Surface Water and Sediments

The PRP contractor collected surface water and sediment samples annually from sample locations in Tributary A (SS12 and SS15) and Tributary B (SS9 and SS14). Sampling occurred more frequently (quarterly or semi-annually) at SS9 and SS14 to evaluate continued detections of 1,2-DCA. Table 13 summarizes the 1,2-DCA detections in surface water at these locations. No other VOCs were detected in the surface water samples above remedial goals, with the exception of carbon tetrachloride and chloroform in 2011 at SS14.

Table 13: 1,2-DCA in Surface Water Samples

Date	1,2-DCA (µg/L)		
	SS9	SS14	Remediation Goal
December 2011	4.6	2.2	0.3
March 2012	2.5	<1	
June 2012	4	NS	
December 2012	4	<1	
April 2013	<1	NS	
December 2013	9.8	4	
March 2014	8.6	1.3	
June 2014	7	NS	
September 2014	<1	<1	
December 2014	<1	1.4	

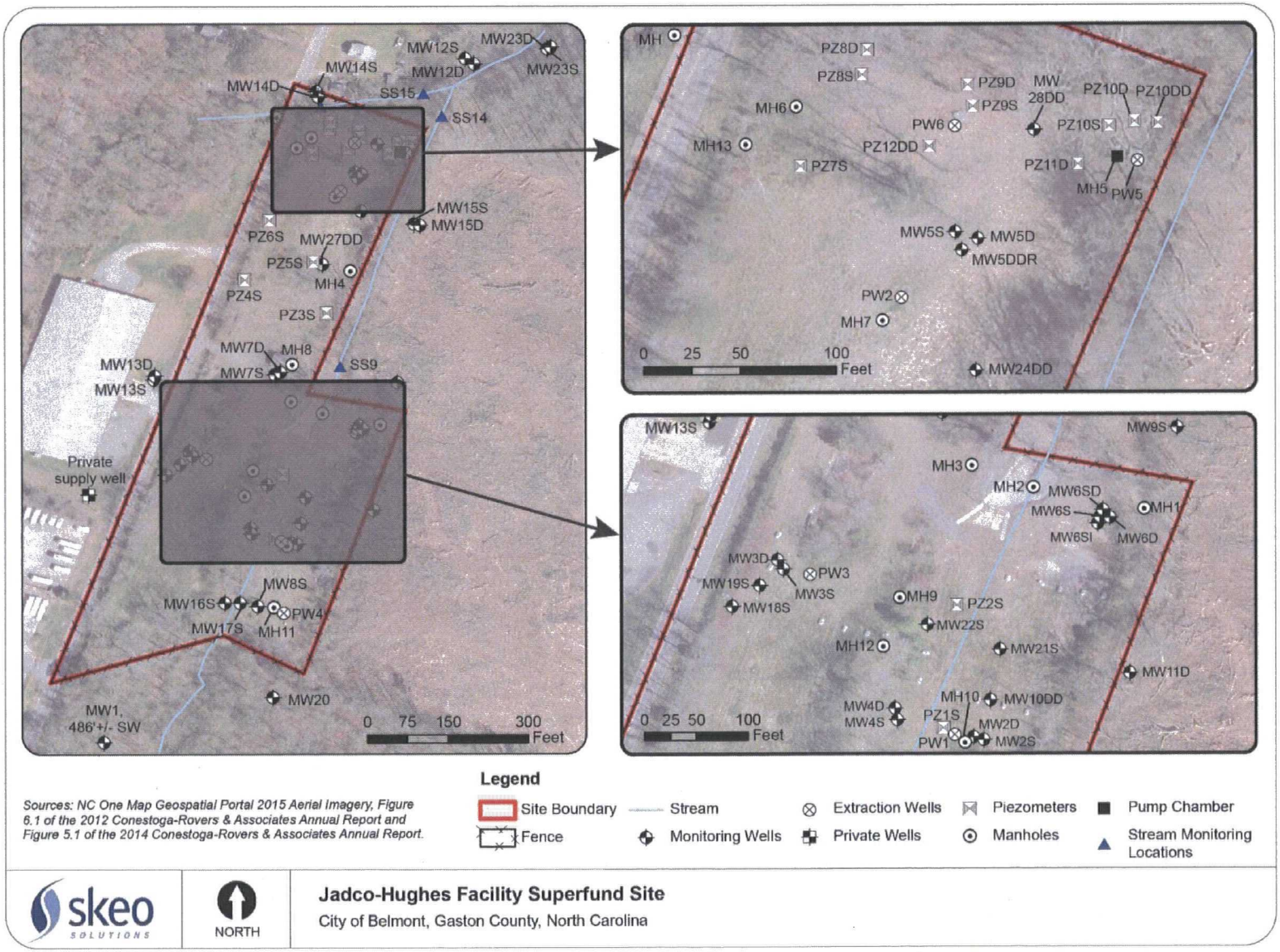
Notes:
NS = not sampled
< 1 indicates no detection at the specified detection limit.
Source: 2011-2014 Annual Report

For sediment samples, the only site-related COC detected during this FYR period was a single occurrence of 1,2-DCA in the sediment sample collected from location SS9 in 2013 at 0.072 milligrams per kilogram (mg/kg). Acetone was periodically detected at all sample locations but is likely related to sample preservation techniques.

Soil Leachate

As part of one of the recommendations from the 2011 FYR, the PRP group collected soil leachate samples from the landfill at manhole MH12 annually. All annual samples showed some amount of contaminants above remedial goals. In December 2011, the sample detected PCE and TCE concentrations greater than the remedial goals, but no SVOCs or PCBs. The December 2012 sample detected concentrations of 1,1-DCA, 1,2-DCA, carbon tetrachloride, chloroform, cis-1,2-DCE, TCE and PCE greater than remedial goals, but also no SVOCs or PCBs. The December 2013 sample detected cis-1,2-DCE below the remedial goals and detected no other VOCs, SVOCs or PCBs. The December 2014 sample detected 1,2-DCA, chloroform, cis-1,2-DCE, PCE and TCE greater than remedial goals but no other VOCs, SVOCs or PCBs, except 1,1-DCE, which was detected at a concentration less than the remedial goal. TCE, PCE and cis-1,2-DCE showed relatively large increases in contaminant concentrations over the period. Further action may be required to address the cause of these increases.

Figure 4: Well, Piezometer and Manhole Locations



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site.

6.5 Site Inspection

On December 15, 2015, the site inspection was performed by the following participants: Michael Townsend of the EPA; Doug Rumford of NCDENR; Michael Simpson of Celanese (another PRP contractor); Brian Sandberg of GHD (PRP contractor; formerly CRA); and Kristin Sprinkle and Brice Robertson of Skeo Solutions (EPA contractor). The site inspection included the following activities: inspection of perimeter fencing, gates, signs, monitoring wells, pumping wells, manholes, piezometers, the treatment building, the landfill cap, drainage facilities and the decommissioned SVE system. The site inspection checklist and photographs are provided in Appendices D and E.

Participants observed that the Site was surrounded by a secured fence in good condition, which was marked with appropriate signage. The treatment building for the pump-and-treat system was in good condition and contained all necessary O&M manuals as well as monthly sampling records. Participants inspected the field containing the pumping wells and found most monitoring wells, manholes and piezometers to be locked and in good condition. Pumping well 5 (PW5) was open to accommodate sampling that day. Participants were able to identify all wells on the site map. Participants also observed the capped landfill with the passive SVE system and found little or no damage to gas vents, monitoring wells and waste tanks. The landfill surface was covered in grass and showed no bulges or erosion. Participants observed the culvert on the east end of the Site that had been constructed since the last FYR. It appeared to be in good working condition. Participants also noted the new development area northeast of the Site. It had been clear-cut, with no erosion controls in place that would keep material from flowing toward the Site and into the creek.

On December 15, 2015, Skeo Solutions visited the site repository at the main branch of the Gaston County Public Library, located at 1555 East Garrison Boulevard in Gastonia, North Carolina. The site repository contained the RI/FS Report, the 1990 ROD and Remedial Addendum. Copies of the 2001 FYR, 2006 FYR, 2011 FYR and 2004 ESD were not available.

6.6 Interviews

The FYR process included interviews with parties affected by the Site, including regulatory agencies involved in site activities or aware of the Site. The purpose was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy implemented to date. All of the interviews took place via email. The interviews are summarized below. Appendix C provides the complete interviews.

Doug Rumford: Doug Rumford represents the State of North Carolina (NCDENR). Overall, Mr. Rumford believes the PRP group and their contractor are managing the project in an efficient and effective manner. He commented that the current remedy is functioning as designed and doing an effective job of removing and treating VOCs in groundwater. However, some off-site migration to the north has occurred. Mr. Rumford also mentioned that North Carolina groundwater standards have been amended since the 2011 FYR but did not know whether the changes will affect the Site. He is comfortable with the status of institutional controls at the Site and believes the recommendations from the 2011 FYR have been sufficiently addressed.

Brian Sandberg and Colleen Dietrich: Brian Sandberg and Colleen Dietrich represent the O&M contractor, GHD, formerly known as CRA. Overall, they believe the remedy is performing in

accordance with the remedial design and remedial action for the Site. They commented that the current remedy is effective in capturing impacted groundwater before it leaves the northern end of the site property boundary. Specifically, Mr. Sandberg and Ms. Dietrich reported that the groundwater extraction system is capturing groundwater throughout the saprolite and partially weathered rock at the northern boundary. They noted that, overall, groundwater VOC concentrations decreased in 2014, with intermediate groundwater VOC concentrations decreasing since 2011.

They commented that there is a continuous O&M presence on site, with monthly, quarterly and semi-annual inspections as specified in the O&M Plan. GHD also monitors groundwater elevations and collects groundwater samples from monitoring wells on an annual basis. They mentioned that the groundwater extraction system was modified between November 2011 and March 2012 by adding two deep groundwater extraction wells, which have performed very well. Because of this, the PRPs discontinued pumping wells PW1, PW2, PW3 and PW4. One problem mentioned for system O&M is that equipment associated with the groundwater extraction system reached its life expectancy and had to be replaced. Mr. Sandberg and Ms. Dietrich also mentioned that the PRPs received approval from the City of Mount Holly to exclude base/neutral acid extractable compounds and 14 metals from the sampling list, resulting in reduced sampling costs. However, the costs to discharge treated groundwater to the municipal sewer have increased over the same period, offsetting any savings. O&M costs have averaged $500,000 annually from 2011 to 2015. They both agree that the recommendations from the 2011 FYR have been sufficiently addressed.

7.0 Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The remedy appears to be functioning as intended by the 1990 ROD and 1994 ESD. The soil and sediment remedy included contaminated soil excavation and capping, SVE and soil flushing. The PRP group started operating the SVE system in 2000. In 2001, the PRP group initiated natural soil flushing in place of the active soil flushing system due to non-detect influent concentrations. In 2003, the PRPs decommissioned the SVE system with EPA approval. Soil leachate sampling performed at MH12 during this FYR period indicated increasing TCE, PCE and cis-1,2-DCE concentrations. The EPA will evaluate these increases and determine if additional actions are necessary.

The selected groundwater remedy included a hot spot pumping and extraction system, with discharge of treated water to the POTW. The groundwater treatment system was modified between November 2011 and March 2012 by adding two deep extraction wells, PW5 and PW6, to contain deep groundwater contamination outside the primary capture area of the existing system. Since implementation of PW5 and PW6, it appears that both intermediate and deep groundwater contamination concentrations are decreasing, and most of the plume is contained. One exception is MW12D, which has shown increasing total VOC concentrations since 2013. The O&M contractor indicated that adjustments to the pumping rate of PW5 may be the cause, but additional action may be necessary to limit further migration of contamination off site and to define the current extent of contamination downgradient of MW12D. Because there are also private wells north of the Site and contamination appears to be migrating off site to the north, further evaluation is needed as to whether this migrating plume could potentially affect these wells. Monitoring data over the FYR period indicate that the perimeter collection system and the deep extraction well system effectively contain the shallow groundwater plume within the site boundaries and decrease overall contaminant concentrations.

1,2-DCA continues to be detected in surface water at SS9 and SS14, located in Tributary B. Additional action may be necessary to address the cause of this contamination.

Current O&M procedures are performed as intended by the 1990 ROD and ensure the protectiveness of the remedy. O&M costs have risen since the previous FYR, most likely due to installation of the deep groundwater extraction system and expansion of the culvert. Optimization of site O&M activities included discontinuation of PW1 through PW4 in 2013 due to operational inefficiencies and redundancy. This will reduce costs of the groundwater extraction system.

Current access controls include complete fencing, a locked gate, and signage surrounding the Site. Institutional controls have been implemented in the form of a 2011 Declaration of Perpetual Land Use Restrictions, conveying several future land use restrictions. These include prohibition of groundwater use beneath the boundaries of the property except for operation of the remediation systems on site; prohibition of site uses for any purpose except for industrial or commercial purposes; and maintaining current on-site engineering controls with no disturbances. These restrictions prevent exposure to site soils and groundwater, as called for in the 1990 ROD.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of remedy selection still valid?

The exposure assumptions, toxicity data and RAOs used at the time of the remedy are still valid. There are no identified ecological routes of exposure, newly identified contaminants or contaminant sources or changes in physical site conditions that would affect the protectiveness of the remedy. The PRP group completed a vapor intrusion assessment in 2013 to determine if vapor intrusion could be a potential exposure pathway for properties north of the Site. The assessment found that vapor intrusion was an incomplete pathway for existing and future structures on these properties. Other than the clear-cutting and planned cellular tower, land uses surrounding the Site are not expected to change. The groundwater extraction system is working to minimize the migration of contaminants off site and groundwater contaminant concentrations are declining overall. The Declaration of Perpetual Land Use Restrictions also satisfies the objective of minimizing contact with site soils, sediments and groundwater. A screening-level risk evaluation indicated that none of the soil cleanup goals exceed a cancer risk of 1 x 10^{-4} or a noncancer HI of 1.0 (See Appendix G).

The 1990 ROD identified groundwater ARARs as the federal and state MCLs, whichever was more stringent. The state ARARs were based off the North Carolina Drinking Water and Groundwater Standards (NCAC Title 15A Chapter 2L) and the ROD adopted these standards for 28 of the 45 COCs. However, since signing of the ROD in 1990, the State of North Carolina amended these standards, effective April 1, 2013, changing the chemical-specific ARARs for some COCs. The organic compounds chlorobenzene, toluene, bis(2-ethylhexyl) phthalate, 1,2-dichlorobenzene, 1,3-dichlorobenzene and phenol have remedial goals that are less stringent than these new standards (Table 6). The inorganic compounds arsenic, barium, cadmium, chromium, manganese, nickel and zinc have remedial goals that are less stringent than the standards (Table 7). All COCs have remedial goals at or below federal MCLs, with the exception of chlorobenzene, 1,3-dichlorobenzene, arsenic and manganese. EPA will determine if these changes in standards necessitate changes to remedial goals.

EPA's dioxin reassessment has been developed and undergone review for many years, with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current guidelines and incorporated the latest data

and physiological/biochemical research into the reassessment. On February 17, 2012, EPA released the final human health non-cancer dioxin reassessment, publishing an oral non-cancer toxicity value, or reference dose (RfD), of $7x10^{-10}$ mg/kg-day for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in EPA's Integrated Risk Information System (IRIS). The dioxin cancer reassessment will follow thereafter. The dioxin RfD was approved for immediate use at Superfund sites to ensure protection of human health. Site contamination included some levels of PCB soil contamination (RI records identify a maximum soil concentration of 189.7 mg/kg). PCBs consist of a number of congeners, which differ in the number and distribution of chlorine atoms attached to the biphenyl molecule. PCB congeners are defined as chemicals with a common carbon molecular structure regardless of the exact molecular formula. There are 209 possible arrangements of chlorine atoms attached to the 10 available carbons on the biphenyl molecule. Analytical methods available at the time of the site investigation and cleanup did not identify the specific PCB congeners. There is a small subset of PCB congeners that display dioxin-like activity. Since congener data are not available for the Site, this may require a review of the Site to confirm the remedy is protective based on the new non-cancer dioxin RfD.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. 1,4-dioxane is a potential co-contaminant of TCA and DCA, which is present in site groundwater, but 1,4-dioxane is not included in groundwater sampling.

7.4 Technical Assessment Summary

The remedy appears to be functioning as intended by the 1990 ROD. However, sampling of landfill leachate indicates that concentrations of three COCs have increased. Monitoring data indicate that the expanded groundwater extraction system is effectively containing the groundwater plume and decreasing overall contaminant concentrations. One exception is MW12D, which has had increasing total VOC concentrations since 2013. Concentrations of 1,2-DCA continue to be detected in surface water at SS9 and SS14 indicating that further action may be necessary to address this contamination.

Current O&M procedures are performed as intended by the 1990 ROD and ensure the protectiveness of the remedy. The exposure assumptions, toxicity data and RAOs used at the time of the remedy are still valid. However, the state and federal ARARs used in identifying the cleanup levels in the 1990 ROD have been updated since the ROD's signing. All COCs have remedial goals at or below the federal MCLs for each compound, with the exception of chlorobenzene, 1,3-dichlorobenzene, arsenic and manganese.

8.0 Issues, Recommendations and Follow-up Actions

Table 14: Issues and Recommendations Identified in the FYR

OU(s): 1	Issue Category: Changed Site Conditions
	Issue: The 15A North Carolina Administrative Code (NCAC) 02L groundwater standards were revised in April 2013. This resulted in updated standards for 12 COCs that are more stringent than the remediation goals set in the 1990 ROD.

	Recommendation: Determine if the changes in the NC 2L standards necessitate changes to the RGs in the ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	**Issue Category: Remedy Performance**			
	Issue: Concentrations of VOCs have increased at monitoring well MW12D, and the soil leachate sample locations since 2013, as well as continued detections of 1,2-DCA at SS9 and SS14.			
	Recommendation: Determine if the drawdown of the groundwater elevation created by the installation of extraction wells PWs 5 & 6 is adequately limiting the migration of contamination towards MW12, and further define the current extent of contamination downgradient of MW12D. Investigate the 1,2-DCA detections at SS9 & 14, and the increasing concentrations at soil leachate sample locations.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	**Issue Category: Monitoring**			
	Issue: 1,4-dioxane is a potential co-contaminant of TCA and DCA, which are present in site groundwater, but 1,4-dioxane is not included in groundwater sampling.			
	Recommendation: Evaluate whether groundwater sampling should include the analysis of 1,4-dioxane.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

OU(s): 1	**Issue Category: Monitoring**			
	Issue: There is a small subset of PCB congeners that display dioxin-like activity. Since congener data are not available for the Site, this may require a review of the Site to confirm dioxin is not a threat to human health and the environment.			
	Recommendation: Investigate the potential presence of dioxin and determine if further action is necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	09/27/2017

The following additional items, though not expected to affect protectiveness, warrant additional follow up:

- Copies of the 2001, 2006 and 2011 FYRs were not available at the document repository. Copies of these FYRs will be sent to the repository in the near future.
- A review of groundwater data identified detection limits for SVOCs (bis(2-chloroethylether) and DEHP) above remedial goals. Analytical methods may need re-evaluation to ensure they can meet remedial goals.

9.0 Protectiveness Statement

Table 15: Protectiveness Statement

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy at the Site currently protects human and the environment in the short term because active remediation of source soil and sediment contamination is complete, groundwater contamination is being treated, there is no human exposure to contaminated groundwater and most institutional controls have been implemented. For the remedies to be protective over the long term, the following actions need to be taken: determine if the changes in the NC2L standards necessitate changes to the RGs that were in the ROD; determine if the drawdown of the groundwater elevation created by the installation of extraction wells PWs 5 & 6 is adequately limiting the migration of contamination towards MW12, and further define the current extent of contamination downgradient of MW12D; Investigate the 1,2-DCA detections at SS9 & 14, and the increasing concentrations at soil leachate sample locations; evaluate whether groundwater sampling should include analysis of 1,4-dioxane; and investigate the potential presence of dioxin and determine if further action is necessary.	

10.0 Next Review

The next FYR will be due within five years of the signature/approval date of this FYR.

Appendix A: List of Documents Reviewed

2011 Annual Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). April 2012.

2012 Annual Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). March 2013.

2013 Annual Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). March 2014.

2014 Annual Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). March 2015.

Declaration of Perpetual Land Use Restrictions. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Filed by Jadco-Hughes PRP Group. July 20, 2011.

Final Design Report, Volume I. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). September 1994.

Five-Year Review Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared by NCDENR, Division of Water Management for U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia. September 2011.

Groundwater Extraction Analysis. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for U.S. Environmental Protection Agency, Region 4 by Contesoga-Rovers & Associates (now GHD). May 7, 2013.

North Boundary Containment Analysis Report. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). August 2012.

Operation and Maintenance Plan. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for Jadco-Hughes PRP Group by Conestoga-Rovers & Associates (now GHD). November 2014.

Record of Decision. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared by the U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia. September 1990.

Status of Third Five-Year Review Report Action Items. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared for U.S. Environmental Protection Agency, Region 4 by GHD (formerly Conestoga-Rovers & Associates). December 1, 2015.

Unilateral Administrative Order. Jadco-Hughes Superfund Site. Belmont, Gaston County, North Carolina. Prepared by U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia. June 28, 1991.

Appendix B: Press Notice

The U.S. Environmental Protection Agency, Region 4 announces a Five-Year Review for The Jadco-Hughes Facility Superfund Site located in North Belmont, Gaston County, North Carolina

Purpose/Objective: The United States Environmental Protection Agency (EPA) has conducted the fourth Five-Year Review of the remedy for the Jadco-Hughes Facility Superfund site in North Belmont, North Carolina. The purpose of the Five-Year Review is to make sure the selected cleanup actions effectively protect human health and the environment.

Site Background: The 6-acre Jadco-Hughes Superfund Site (the Site) is located on Cason Street in North Belmont, Gaston County, North Carolina. From 1969 until 1975, a waste oil and solvent recovery and disposal facility operated on site. During facility operations, spills of ink solvents, lubricants, petroleum products and other unknown chemicals occurred, contaminating site soils, sediments and groundwater.

Cleanup Actions: The EPA placed the Site on the National Priorities List (NPL) in 1986 and selected a remedy in a 1990 Record of Decision (ROD). The remedy for soil and sediments included soil vapor extraction (SVE) and soil flushing. Active soil and sediment remediation is complete, so only natural soil flushing is occurring at the Site. The selected remedy for groundwater included an extraction and treatment system and institutional controls to prevent site groundwater use. The remedy also included access restrictions, long-term monitoring and an on-site culvert to prevent contaminated groundwater discharge to a nearby tributary. Remediation of source soil and sediment contamination is complete; groundwater contamination is being treated; there is not human exposure to contaminated groundwater; and most institutional controls have been implemented.

Five-Year Review Schedule: The NPL requires review of remedial actions that result in any hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure every five years to ensure the protection of human health and the environment. The fourth of the Five-Year Reviews for the Site will be completed by September 2016.

Michael Townsend, EPA Remedial Project Manager
Phone: (404) 562-8813
Email: townsend.michael@epa.gov

Angela Miller, EPA Community Involvement Coordinator
Phone: (404) 562-8561
Email: miller.angela@epa.gov

Mailing Address: U.S. EPA Region 4, 61 Forsyth Street, S.W., 11th Floor, Atlanta, GA 30303-8960

Site information is also available at the local document repository, located at the Gaston County Public Library, 1555 East Garrison Boulevard in Gastonia, North Carolina, and online at https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0403079.

Appendix C: Interview Forms

Jadco-Hughes Facility Superfund Site **Five-Year Review Interview Form**

Site Name: Jadco-Hughes Facility **EPA ID No.:** NCD980729602
Interviewer Name: Amanda Goyne and Brice Robertson **Affiliation:** Skeo Solutions
Subject Name: Doug Rumford **Affiliation:** North Carolina DENR
Subject Contact Information:
Time: 09:15 a.m. **Date:** 01/04/16
Interview Location: NCDENR-Raleigh

Interview Format (circle one): In Person Phone Mail Other: Email

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?
   The PRP Group and their contractor are managing the project in an efficient and effective manner.

2. What is your assessment of the current performance of the remedy in place at the Site?
   The current remedy in place is functioning as designed and doing an effective job of removing and treating VOCs in groundwater. However, some off-site migration to the north has occurred.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?
   No.

4. Has your office conducted any site-related activities or communications in the past five years apart from standard communications? If so, please describe the purpose and results of these activities.
   No.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?
   North Carolina groundwater standards have been amended since the 2011 FYR.

6. Do you feel that the recommendations from the 2011 FYR have been sufficiently addressed?
   Yes.

7. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?
   Yes.

8. Are you aware of any changes in projected land use(s) at the Site?
   None for the site but adjacent property to the west appears to be in the process of being developed for unknown purpose.

9. Do you have any additional comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   No.

Jadco-Hughes Facility Superfund Site **Five-Year Review Interview Form**

Jadco-Hughes Facility	**EPA ID No.: NCD980729602**	
Interviewer Name:	**Amanda Goyne and Brice Robertson**	**Affiliation: Skeo Solutions**
Subject Name:	**Brian Sandberg/Colleen Dietrich**	**Affiliation: GHD**
Subject Contact Information:	brian.sandberg@ghd.com / colleen.dietrich@ghd.com	
Time:_____	**Date: January 13, 2015**	
Interview Location:	**Electronic**	
Interview Format (circle one):	**In Person**	**Phone:** **Mail:** **Other: (Email)**
Interview Category:	**O&M Contractor**	

1. **What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?**
   The remedy is performing in accordance with the requirements of the EPA's Administrative Order for the Remedial Design/Remedial Action (RD/RA) at the Site (Order), Docket No. 91-31-C, dated June 19, 1991.

2. **What is your assessment of the current performance of the remedy in place at the Site?**
   Overall, the current operating remedy is effective in capturing impacted groundwater before it leaves the northern end of the site property boundary.

3. **What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?**
   GHD (formerly Conestoga-Rovers & Associates) has concluded the following based on the monitoring data at the Site, as documented in the North Boundary Containment Analysis Report (CRA, 2012b) and the 2012 to 2014 Annual Reports (CRA, 2013a, 2014a, 2015) and Quarterly Progress Report – July through September 2015 (GHD, 2015):

   - *The groundwater contours provide strong lines of evidence that the combined pumping of the perimeter collection system and the deep well groundwater extraction system is capturing groundwater throughout the saprolite and partially weathered rock at the northern property boundary.*
   - *The cone of depression created by groundwater pumping extends off Site such that it is capturing off-site groundwater to the north.*

   GHD has also identified the following key trends in contaminant levels:

   - *Overall, the groundwater VOC concentrations decreased in 2014 when compared to the 2013 groundwater concentrations (CRA, 2015).*
   - *The groundwater VOC concentrations have been reduced in the intermediate groundwater since 2011. The deep extraction wells at the north end of the property boundary have reduced the groundwater concentrations by removing contaminant mass in the intermediate and deep groundwater (CRA, 2013a, 2014a, 2015).*

4. **Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.**
The Site is secured with a chain link fence and locked gates surrounding the property. As the O&M Contractor, GHD periodically visits the Site to perform monthly, quarterly and semi-annual inspections in accordance with the O&M Plan (CRA, 2014b) and to maintain equipment as needed. GHD also responds to system alarms. GHD monitors groundwater elevations and collects groundwater samples from monitoring wells on an annual basis in accordance with the O&M Plan.

5. **Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.**
The PRP group modified the groundwater extraction system between November 2011 and March 2012 by bringing two deep groundwater extraction wells (PW5 and PW6) online in accordance with CRA's February 7, 2011 work plan (CRA, 2011). Subsequent containment evaluations (CRA 2012b, 2013a, 2014a, 2015 and GHD, 2015) have concluded that the combined pumping of the perimeter collection system and the deep well groundwater extraction system is capturing groundwater throughout the saprolite and PWR at the northern property boundary. The scope of the system modifications are presented in the Remedial Action Report-System Modifications (CRA, 2012a).

In May 2013, the PRP Group evaluated the continued use of groundwater extraction wells PW1 through PW4 (CRA, 2013b). The groundwater extraction analysis examined whether or not these wells were maintaining source control, which was their intended purpose in the original RD (CRA, 1994). The study concluded that extraction wells PW1 through PW4 were no longer providing effective source control given the effectiveness of the then-recently installed PW5 and PW6. Therefore, the operation of PW1, PW2 and PW4 was discontinued.

The PRP group subsequently completed a vertical aquifer profiling (VAP) analysis and evaluation at a location proposed to potentially replace extraction well PW3 in June 2013, and concluded that installing a replacement extraction well in the PWR zone would not be effective (CRA, 2013c). Based on this conclusion, the PRP Group discontinued the operation of PW3 and allowed the impacted groundwater in the area of MW3S and MW3D to be captured by the shallow collection trench, and the deep extraction wells at the north end of the Site, as described in CRA's October 11, 2013 letter report to EPA regarding the same (CRA, 2013c).

The modifications to the groundwater extraction system have enhanced the protectiveness of the remedy by expanding the capture zone of the extraction system to more effectively capture groundwater from the saprolite and PWR.

6. **Have there been unexpected O&M difficulties or costs at the Site in the last five years? If so, please provide details.**
As described in the third quarterly progress report for 2015 (GHD, 2015), certain mechanical and other equipment associated with the groundwater treatment system reached or exceeded their expected life after almost 20 years of operation and maintenance, and were replaced and/or upgraded, including the two aeration blowers, and the pump in MW5.

7. **Please provide approximate annual operation and maintenance costs over the past five years.**
Operation and maintenance costs averaged approximately $500,000 annually between 2011 and 2015.

8. **Do you feel that the recommendations from the 2011 FYR have been sufficiently addressed?**
Yes, the recommendations from the 2011 FYR have been sufficiently addressed. Please refer to GHD's letter dated December 1, 2015 confirming the completion status for the recommendations and action items included in the 2011 FYR (provided to EPA on December 1, 2015, and provided to Skeo on December 17, 2015).

9. **Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.**
As described in Item 5 above, the PRP group further optimized the groundwater extraction system during the past five-year period to enhance groundwater capture throughout the saprolite and PWR at the northern property boundary. While these modifications have not resulted in significant cost savings to the group, they have improved the performance of the extraction system and protectiveness of the remedy.

In addition, the PRP group received approval from the City of Mount Holly (City) on March 31, 2014, to exclude base/neutral and acid extractable (BNA) compounds and 14 metals not included in the City's Sewer Use Ordinance from the annual effluent sampling analyte list, resulting in reduced sampling and analytical costs. Over the same period, the PRP group's costs to discharge treated groundwater from the Site to the municipal sewer have increased, which has more than offset any potential savings realized by the reduced sampling requirements.

10. **Do you have any additional comments, suggestions or recommendations regarding O&M activities and schedules at the Site?**
No additional comments.

REFERENCES:

CRA, 1994. Final Design Report. Conestoga-Rovers & Associates. September 1994.
CRA, 2011. Work Plan for Modifying the Groundwater Extraction System, February 7, 2011.
CRA, 2012a. Remedial Action Report – System Modifications. August 2012.
CRA, 2012b. North Boundary Containment Analysis Report. August 2012.
CRA, 2013a. 2012 Annual Report. March 2013.
CRA, 2013b. Groundwater Extraction Analysis Letter to USEPA. May 7, 2013.
CRA, 2013c. Vertical Aquifer Profiling at Proposed PW3 Location. October 11, 2013.
CRA, 2014a. 2013 Annual Report. March 2014.
CRA, 2014b. O&M Plan. November 2014.
CRA, 2015. 2014 Annual Report. March 2015.
GHD, 2015. Quarterly Progress Report - July through September 2015. November 3, 2015.
GHD, 2015. Status of Third Five-Year Review Report Action Items. December 1, 2015. (enclosed)

1. September 8, 2011 telephone conversation with Michael Townsend, United States Environmental Protection Agency (EPA).

2. 2011 Annual Report, Conestoga Rovers & Associates (CRA), April 2012.
3. North Boundary Containment Analysis Report, CRA, August 2012.
4. 2012 Annual Report, CRA, March 2013.
5. 2013 Annual Report, CRA, March 2014.
6. April 26, 2013 Quarterly Progress Report - January through March 2013.
7. May 8, 2013 Monitoring Well Installation Work Plan to United States Environmental Protection Agency (EPA) from CRA.
8. May 14, 2013 Evaluation of Vapor Intrusion Exposure Pathway for Residents North of Site letter to USEPA from CRA, including May 7, 2014 evaluation memorandum.
9. November 18, 2014 Off-Site Vertical Aquifer Profiling letter from CRA to EPA.
10. 2014 Annual Report, Conestoga Rovers & Associates, March 2015.
11. November 3, 2015 Quarterly Progress Report - July through September 2015.

Appendix D: Site Inspection Checklist

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Jadco-Hughes Superfund Site	**Date of Inspection:** 12/15/2015
Location and Region: Belmont, NC/Region 4	**EPA ID:** NCD980729602
Agency, Office or Company Leading the Five-Year Review: EPA Region 4	**Weather/Temperature:** 72 degrees Fahrenheit, sunny

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pumping and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Brian Sandberg (Name) | Hydrogeologist (Title) | 1/14/2016 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone ☒ by email Phone: _____
   Problems, suggestions ☐ Report attached: Yes

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency NCDENQ
   Contact Doug Rumford (Name) | Hydrogeologist (Title) | 1/4/2016 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: Yes

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached: _____

4. **Other Interviews** (optional) ☐ Report attached: _____

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☐ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☒ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A

☒ Contingency plan/emergency response plan ☒ Readily available ☐ Up to date ☐ N/A

Remarks: _____

3. **O&M and OSHA Training Records** ☒ Readily available ☐ Up to date ☐ N/A

Remarks:

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☒ Readily available	☒ Up to date	☐ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks:

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A

Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☒ Readily available ☐ Up to date ☐ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☒ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: $2,665,600 for 30 years of operation ☐ Breakdown attached

Total annual cost by year for review period if available

From: 2011 (Date) To: 2015 (Date) $2,500,000 (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: Construction of deep groundwater wells and concrete culvert.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Signage on fences.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☒ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☒ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: _____

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: RPM mentioned there might be trespassing from kids, but no real damage.

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☐ N/A

Remarks: New development upslope of the Site. The RPM and O&M contractor said developers have not contacted them about its proximity to the Site.

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads Damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A

Remarks: _____

B. Other Site Conditions

Remarks: Site visit took place on a sampling day, so gates were unlocked with some pumping wells and manholes open.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Arial extent: _____ Depth: _____

Remarks: _____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

Lengths: _____ Widths: _____ Depths: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Arial extent: _____ Depth: _____
Remarks: _____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Arial extent: _____ Depth: _____
Remarks: _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established
☒ No signs of stress ☐ Trees/shrubs (indicate size and locations on a diagram)
Remarks: _____

6. **Alternative Cover** (e.g., armored rock, concrete) ☒ N/A
Remarks: _____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Arial extent: _____ Height: _____
Remarks: _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Arial extent: _____
☐ Ponding ☐ Location shown on site map Arial extent: _____
☐ Seeps ☐ Location shown on site map Arial extent: _____
☐ Soft subgrade ☐ Location shown on site map Arial extent: _____
Remarks: _____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map
☒ No evidence of slope instability
Arial extent: _____
Remarks: _____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive
☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☒ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: PW5 a little low.

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☒ Good condition ☐ Needs maintenance

Remarks: Replaced equipment fall 2015 and rebuilt pumps and blowers.

3. **Spare Parts and Equipment**

☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Collection Structures, Pumps and Electrical**

☒ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☒ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually: 13 million gallons

☐ Quantity of surface water treated annually: _____

Remarks: _____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

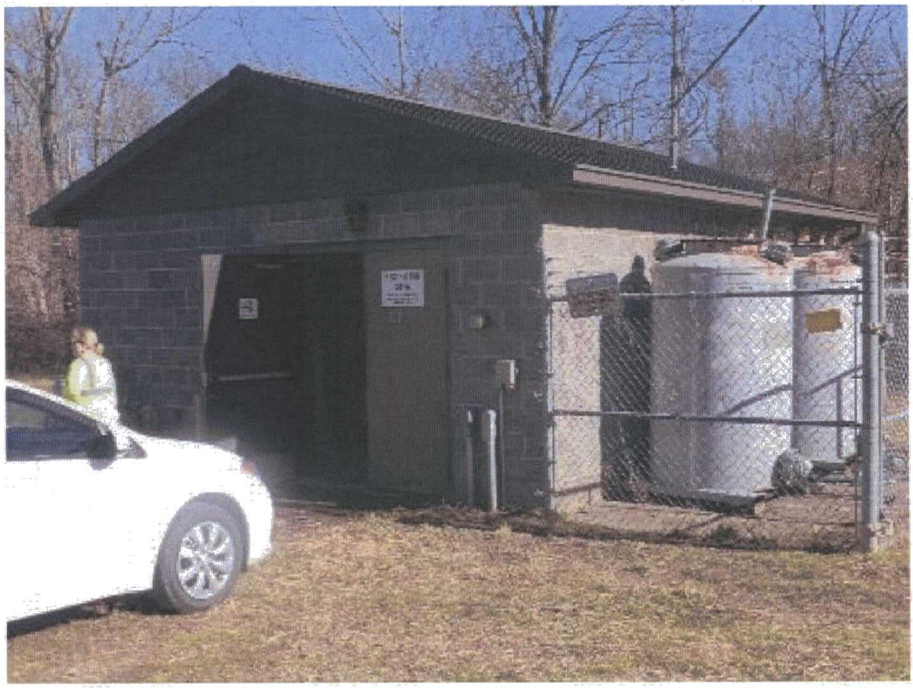
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☒ All required wells located ☐ Needs maintenance ☐ N/A Remarks: _____	
D. Monitoring Data	
1. **Monitoring Data** ☒ Is routinely submitted on time ☒ Is of acceptable quality	
2. **Monitoring Data Suggests:** ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining	
E. Monitored Natural Attenuation	
1. **Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs maintenance ☒ N/A Remarks: _____	
X. OTHER REMEDIES	
If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	
XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions). The remedy is designed to remediate contaminated site soils, contain the groundwater plume, remediate contaminated site groundwater and restrict access to site soils and groundwater. Site soils have been completely remediated. The current groundwater remedy is effective and functioning as designed. However, there are a few instances of the plume not being contained in the northern part of the site. Most contaminant concentrations are above remediation goals, but show a decreasing trend over time. Institutional controls are in place to restrict access to site soils and groundwater.	
B.	**Adequacy of O&M**
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. O&M procedures are implemented and performed as designated by the 2014 O&M Plan. Site features are well maintained and monitoring is performed as scheduled.	
C.	**Early Indicators of Potential Remedy Problems**
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. There are none.	
D.	**Opportunities for Optimization**
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. There are none.	

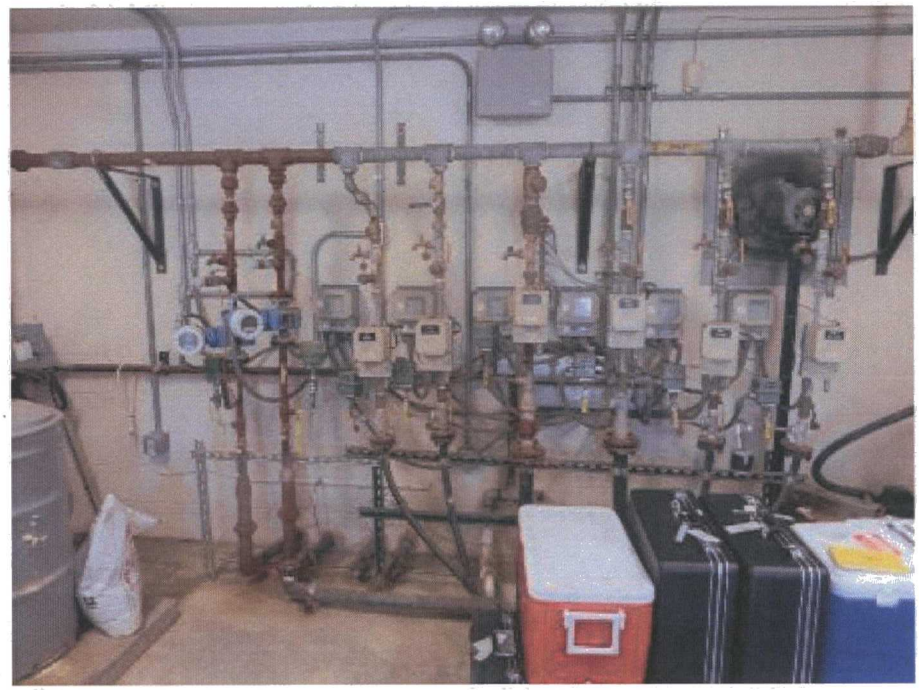
Site Inspection Team:

- Michael Townsend, EPA Region 4, townsend.michael@epa.gov
- Michael Simpson, Celanese, michael.simpson.contractor@celanese.com
- Brian Sandberg, GHD, brian.sandberg@ghd.com
- Doug Rumford, North Carolina Department of Energy and Natural Resources doug.rumford@ncdenr.gov
- Kristin Sprinkle, Skeo Solutions, ksprinkle@skeo.com
- Brice Robertson, Skeo Solutions, brobertson@skeo.com

Appendix E: Photographs from Site Inspection Visit



Building containing groundwater treatment system



One component of the groundwater treatment system

Monitoring well 5DD, MW5DD, used to monitor groundwater remediation

Pumping well 5, PW5, used to address groundwater contamination

Piezometer 10DD (PZ10DD), used to measure groundwater pressure

Manhole 5 (MH5), used to access municipal water system

Pumping well 6 (PW6), used to address groundwater remediation

View of north end of the Site containing monitoring wells, pumping wells and piezometers

Gates surrounding the site and gate entrance

View of industrial waste holding tanks at the south end of the Site

View of the discontinued SVE system at the south end of the Site

View of the recently completed on-site culvert

Appendix F: Supporting Documents for Data Review

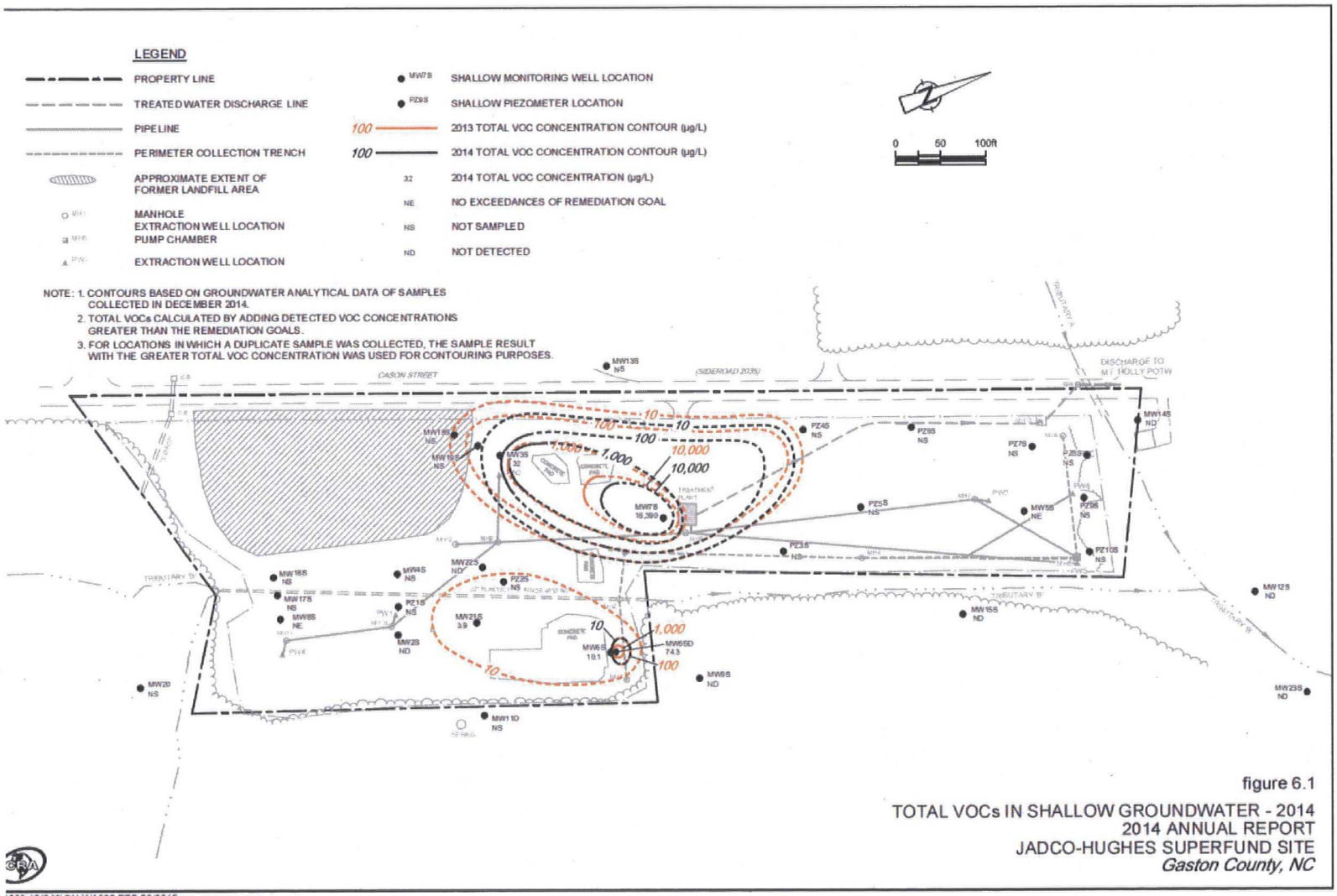


figure 6.1
TOTAL VOCs IN SHALLOW GROUNDWATER - 2014
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
Gaston County, NC

CRA

\669-10(046)GN-WA036 FEB 23/2015

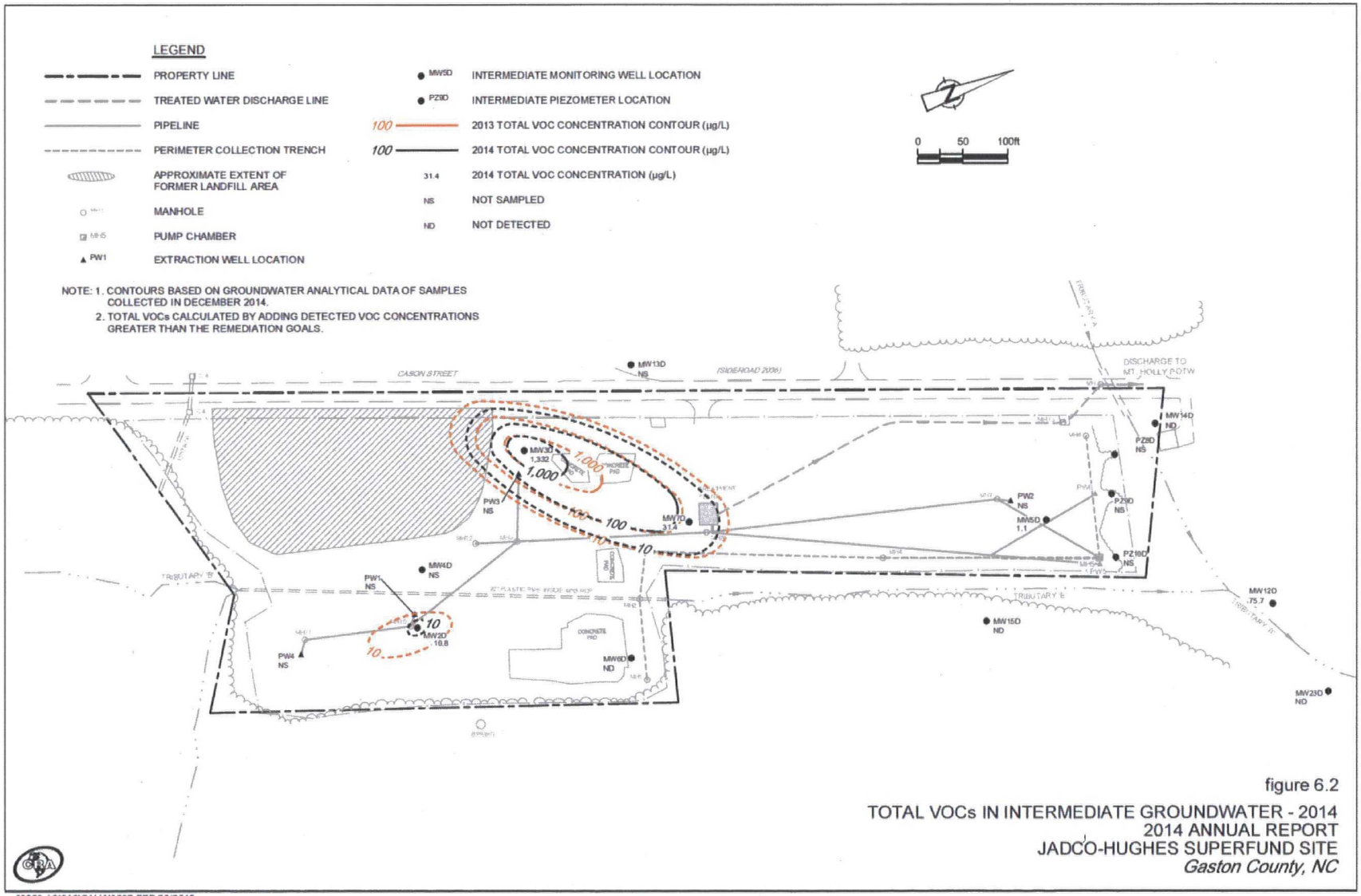


figure 6.2

TOTAL VOCs IN INTERMEDIATE GROUNDWATER - 2014
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
Gaston County, NC

03669-10(046)GN-WA037 FEB 23/2015

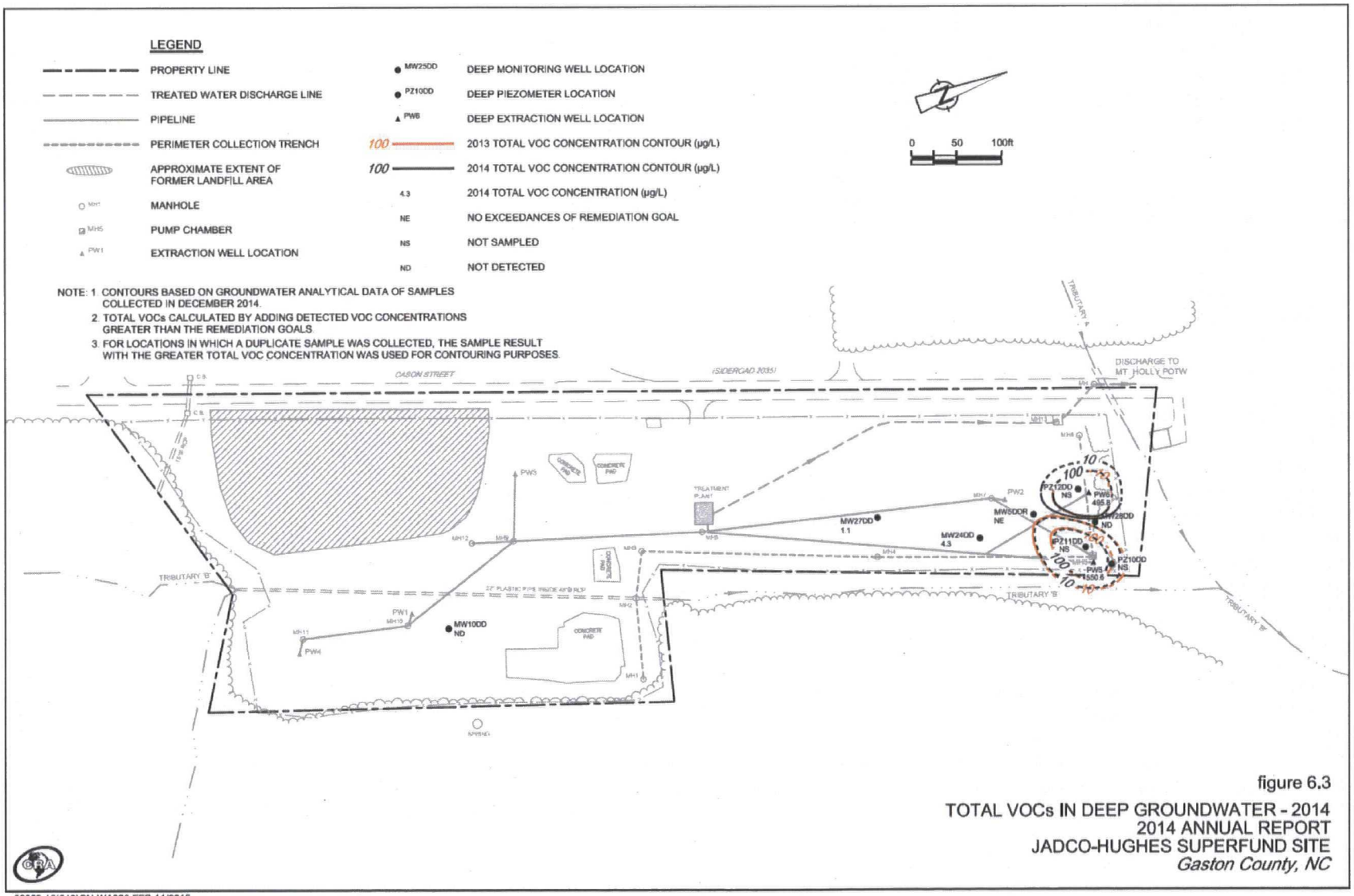


figure 6.3

TOTAL VOCs IN DEEP GROUNDWATER - 2014
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
Gaston County, NC

03669-10(046)GN-WA038 FEB 11/2015

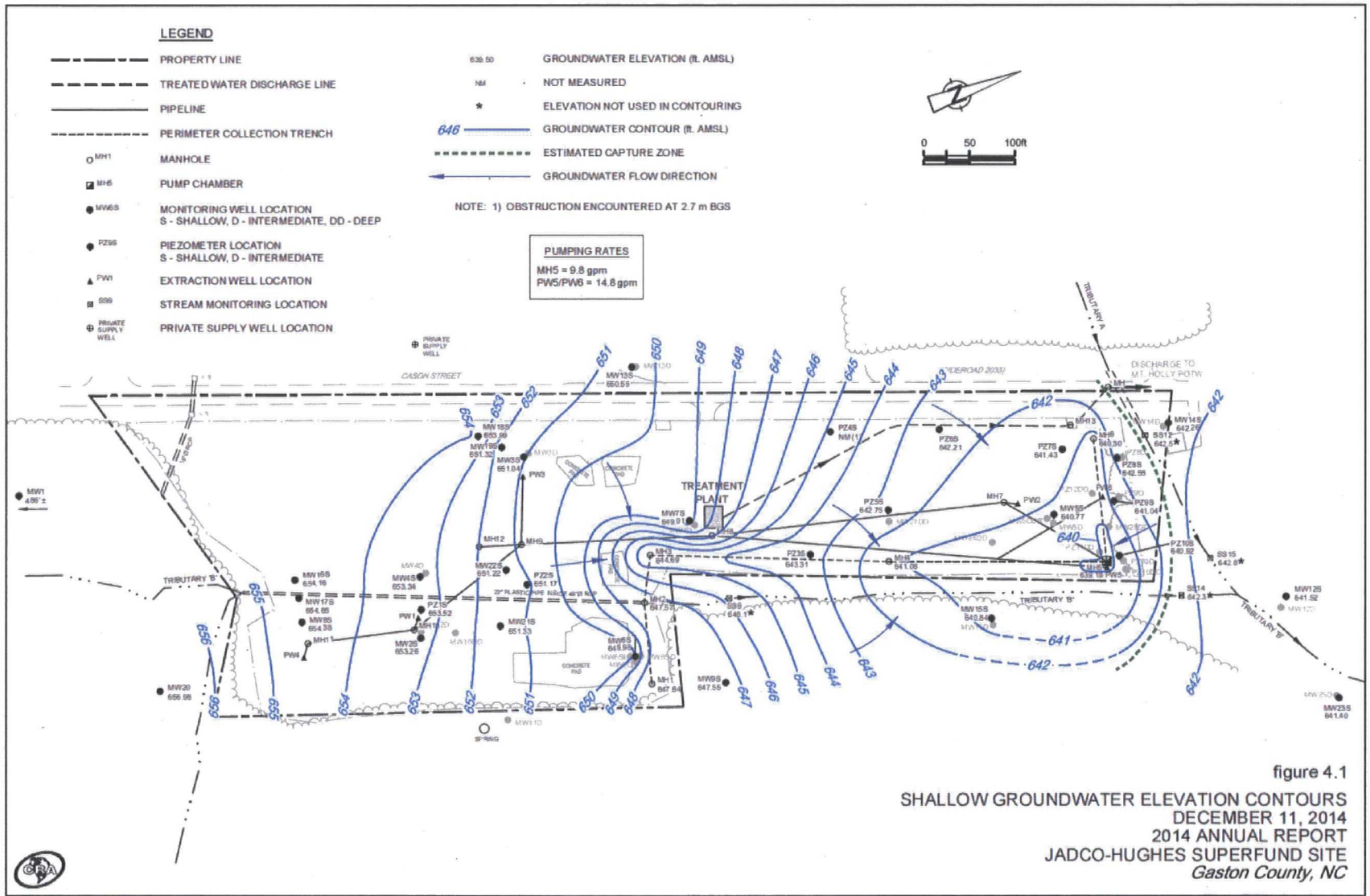


figure 4.1

SHALLOW GROUNDWATER ELEVATION CONTOURS
DECEMBER 11, 2014
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
Gaston County, NC

03689-10(046)GN-WA007 MAR 27/2015

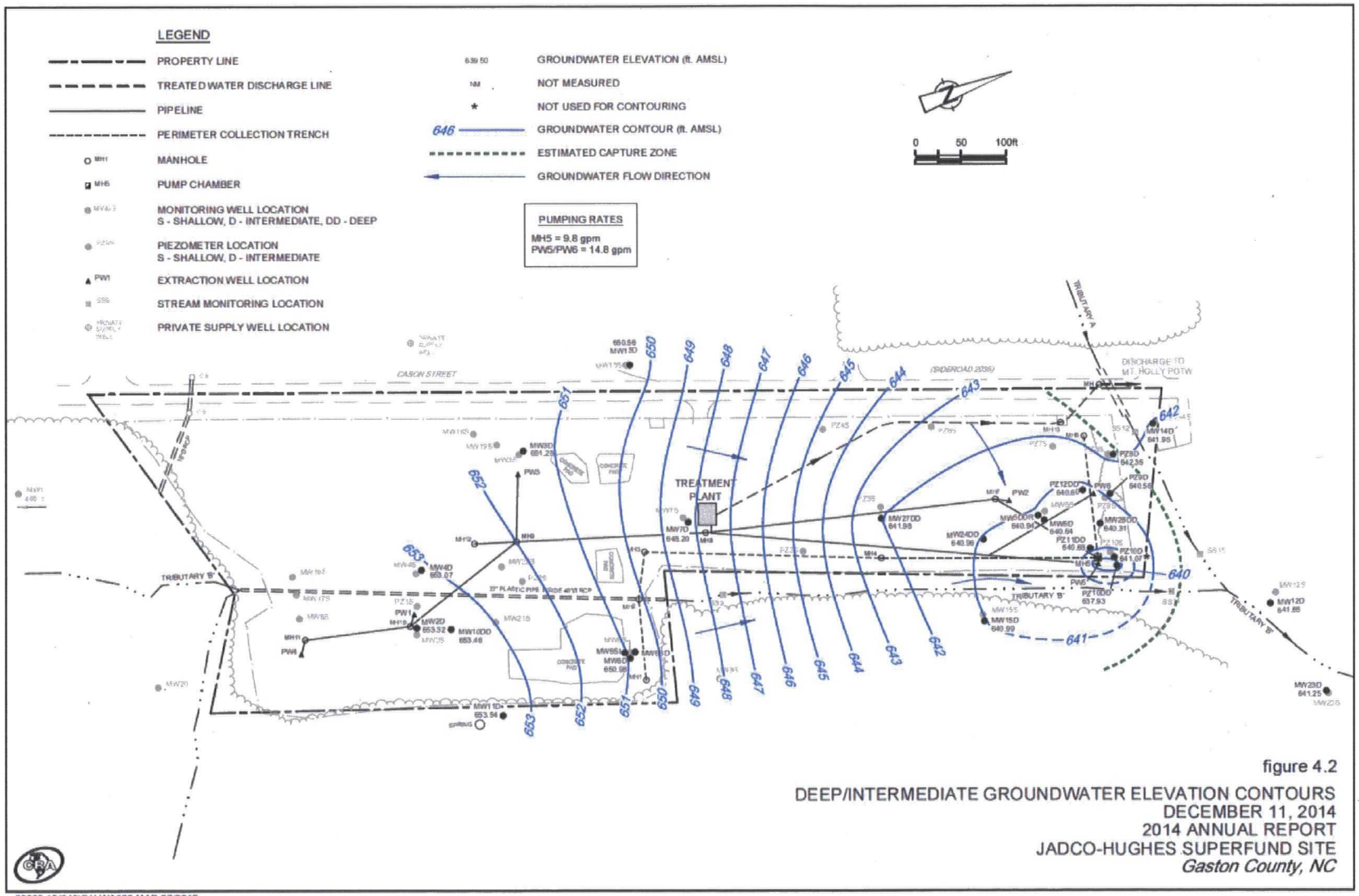


figure 4.2

DEEP/INTERMEDIATE GROUNDWATER ELEVATION CONTOURS
DECEMBER 11, 2014
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
Gaston County, NC

03669-10(046)GN-WA008 MAR 27/2015

TABLE 5.2

MANN-KENDALL TREND TEST RESULTS FOR CHEMICAL CONCENTRATIONS IN GROUNDWATER
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
GASTON COUNTY, NORTH CAROLINA

Well	Analyte	Unit	Number of Samples	Percent ND	Mann-Kendall Trend Test: Number of Samples	Mann-Kendall Trend Test: Percent ND	Mann-Kendall Trend Test: Statistic	Mann-Kendall Trend Test: Probability	Mann-Kendall Trend Test: Conclusion
MW2D									
	1,1-Dichloroethane	µg/L	25	12%	17	0%	-98	6.5E-05	**Decreasing Trend**
	1,2-Dichloroethane	µg/L	25	12%	17	12%	-105	1.8E-05	**Decreasing Trend**
	1,4-Dichlorobenzene	µg/L	19	0%	15	0%	-78	1.4E-04	**Decreasing Trend**
	Benzene [1]	µg/L	25	16%	17	6%	-113	3.9E-06	**Decreasing Trend**
	Vinyl chloride [1]	µg/L	25	40%	15	7%	-61	0.003	**Decreasing Trend**
MW3S									
	1,2-Dichloroethane [1]	µg/L	30	63%	14	50%	-24	0.176	No trend identified
	Carbon tetrachloride	µg/L	30	0%	17	0%	-88	0.000	**Decreasing Trend**
	Chloroform (Trichloromethane)	µg/L	30	17%	16	0%	-37	0.105	No trend identified
	Trichloroethene [1]	µg/L	30	67%	9	11%	-10	0.348	No trend identified
MW3D									
	1,1-Dichloroethane	µg/L	25	48%	16	19%	69	0.002	**Increasing Trend**
	1,2-Dichloroethane	µg/L	25	20%	16	0%	43	0.059	No trend identified
	Benzene	µg/L	25	48%	16	31%	35	0.119	No trend identified
	bis(2-Chloroethyl)ether	µg/L	14	29%	14	29%	17	0.375	No trend identified
	Carbon tetrachloride	µg/L	25	0%	17	0%	-46	0.064	No trend identified
	Chloroform (Trichloromethane)	µg/L	25	0%	17	0%	110	6.9E-06	**Increasing Trend**
	cis-1,2-Dichloroethene [1]	µg/L	15	7%	13	0%	-4	0.855	No trend identified
	Methylene chloride	µg/L	25	44%	14	7%	48	0.010	**Increasing Trend**
	Tetrachloroethene	µg/L	25	52%	16	38%	28	0.210	No trend identified
	Trichloroethene	µg/L	25	24%	15	0%	41	0.047	**Increasing Trend**
MW5D									
	1,2-Dichloroethane [1]	µg/L	37	16%	17	6%	-48	0.053	No trend identified
	Chloroform (Trichloromethane) [1]	µg/L	37	51%	15	20%	-14	0.518	No trend identified
	Tetrachloroethene	µg/L	37	68%	13	15%	-5	0.805	No trend identified
MW5DDR									
	1,2-Dichloroethane [1]	µg/L	56	96%	19	89%	--	--	>50% ND
	Chloroform (Trichloromethane) [1]	µg/L	56	54%	9	11%	0	1.000	No trend identified
	cis-1,2-Dichloroethene [1]	µg/L	46	13%	15	27%	59	0.004	**Increasing Trend**
	Tetrachloroethene [1]	µg/L	36	44%	10	10%	-3	0.858	No trend identified
	Trichloroethene [1]	µg/L	56	29%	19	37%	46	0.105	No trend identified
MW6S									
	1,4-Dichlorobenzene	µg/L	25	56%	14	36%	8	0.659	No trend identified
	Benzene	µg/L	19	58%	13	54%	--	--	>50% ND
	bis(2-Chloroethyl)ether	µg/L	27	15%	14	21%	-18	0.295	No trend identified
	Chloroethane [1]	µg/L	13	85%	10	80%	--	--	>50% ND
	Vinyl chloride [1]	µg/L	39	3%	19	5%	-101	1.5E-04	**Decreasing Trend**
MW6SD									
	1,2-Dichloroethane	µg/L	20	0%	12	0%	-42	0.005	**Decreasing Trend**
	1,4-Dichlorobenzene	µg/L	11	64%	10	60%	--	--	>50% ND
	Benzene	µg/L	20	80%	12	67%	--	--	>50% ND
	Chloroethane [1]	µg/L	13	54%	11	45%	-4	0.805	No trend identified
	cis-1,2-Dichloroethene [1]	µg/L	20	0%	12	0%	-4	0.837	No trend identified
	trans-1,2-Dichloroethene [1]	µg/L	20	50%	12	17%	19	0.216	No trend identified
	Vinyl chloride	µg/L	20	0%	12	0%	-15	0.336	No trend identified
MW7S									
	Carbon tetrachloride	µg/L	25	8%	17	6%	77	0.001	**Increasing Trend**
	Chloroform (Trichloromethane)	µg/L	25	8%	17	18%	20	0.390	No trend identified

2

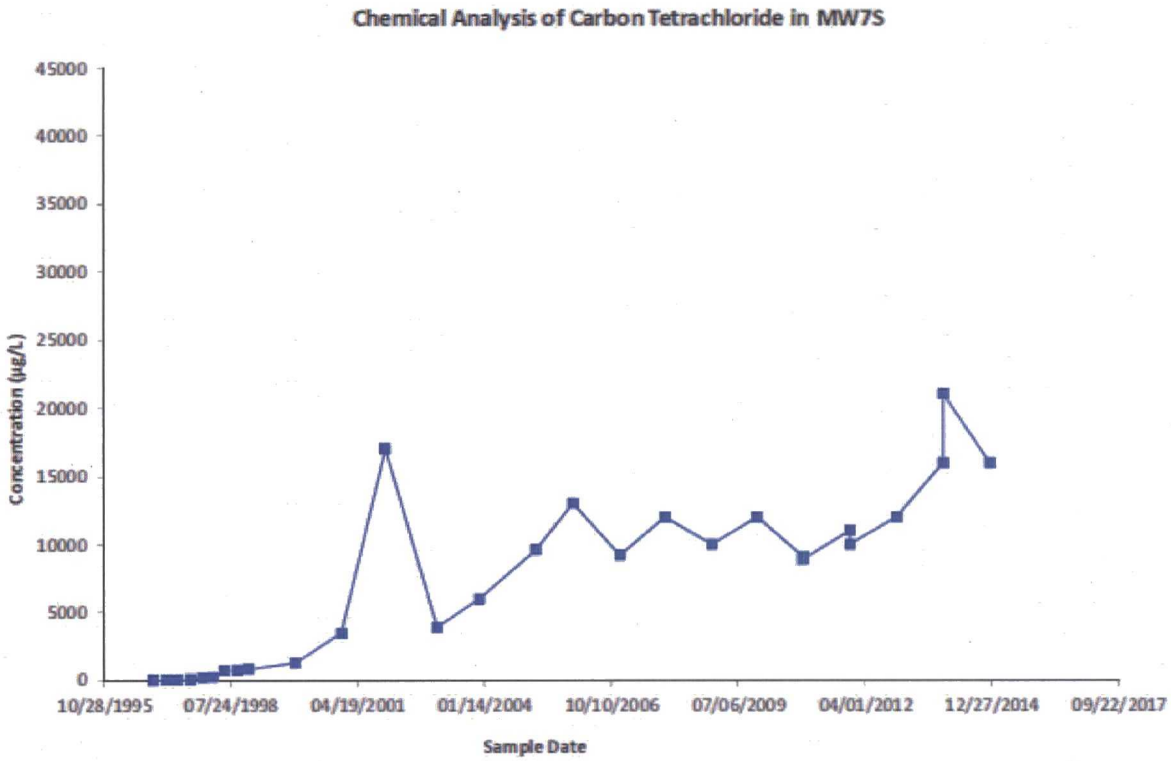
TABLE 5.2

MANN-KENDALL TREND TEST RESULTS FOR CHEMICAL CONCENTRATIONS IN GROUNDWATER
2014 ANNUAL REPORT
JADCO-HUGHES SUPERFUND SITE
GASTON COUNTY, NORTH CAROLINA

					Mann-Kendall Trend Test				
Well	*Analyte*	*Unit*	*Number of Samples*	*Percent ND*	*Number of Samples*	*Percent ND*	*Statistic*	*Probability*	*Conclusion*
MW7D									
	1,1-Dichloroethane	µg/L	9	0%	7	0%	-13	0.072	No trend identified
	1,2-Dichloroethane	µg/L	9	0%	7	0%	-7	0.368	No trend identified
	Chloroform (Trichloromethane)	µg/L	9	0%	7	0%	-11	0.133	No trend identified
	Tetrachloroethene	µg/L	9	0%	7	0%	-9	0.230	No trend identified
	Trichloroethene	µg/L	9	0%	7	0%	-11	0.133	No trend identified
MW12D									
	Chloroform (Trichloromethane)	µg/L	57	18%	18	17%	84	0.002	**Increasing Trend**
	Tetrachloroethene	µg/L	53	72%	17	29%	31	0.014	**Increasing Trend**
	Trichloroethene	µg/L	57	11%	18	17%	110	3.5E-05	**Increasing Trend**
MW21S									
	1,4-Dichlorobenzene	µg/L	16	0%	10	0%	-11	0.371	No trend identified
MW22S									
	1,4-Dichlorobenzene [1]	µg/L	16	94%	20	95%	–	–	>50% ND
MW24DD									
	1,1-Dichloroethane	µg/L	15	0%	14	0%	-17	0.371	No trend identified
	Carbon tetrachloride [1]	µg/L	15	60%	14	57%	--	-	>50% ND
	Chloroform (Trichloromethane)	µg/L	15	13%	14	14%	-20	0.288	No trend identified
	Tetrachloroethene	µg/L	15	7%	14	7%	-5	0.826	No trend identified
MW27DD									
	1,1-Dichloroethane	µg/L	14	7%	14	7%	-6	0.784	No trend identified
	Chloroform (Trichloromethane) [1]	µg/L	14	93%	14	93%	--	–	>50% ND
	Tetrachloroethene [1]	µg/L	14	86%	14	86%	–	–	>50% ND
MW28DD									
	Carbon tetrachloride [1]	µg/L	14	50%	14	50%	-58	0.001	**Decreasing Trend**
	Chloroform (Trichloromethane) [1]	µg/L	14	29%	14	29%	-73	6.5E-05	**Decreasing Trend**
	Tetrachloroethene [1]	µg/L	14	43%	14	43%	-68	1.3E-04	**Decreasing Trend**
	Trichloroethene [1]	µg/L	14	29%	14	29%	-73	6.5E-05	**Decreasing Trend**

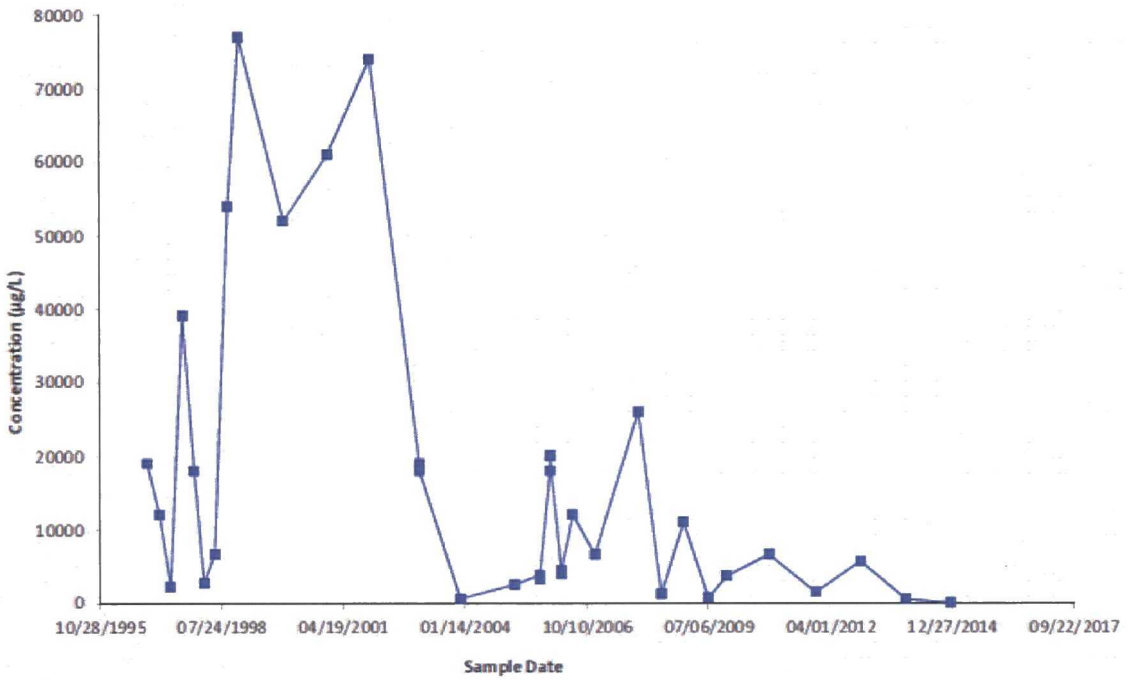
Notes:

Trends were calculated using data combined into annual averages to account for different sampling frequencies over time.
Annual averages were not done for wells MW24DD, MW27DD and MW28DD.
[1] Did not exceed groundwater Remediation Goal in 2014; however, parameter did exceed in 2013.



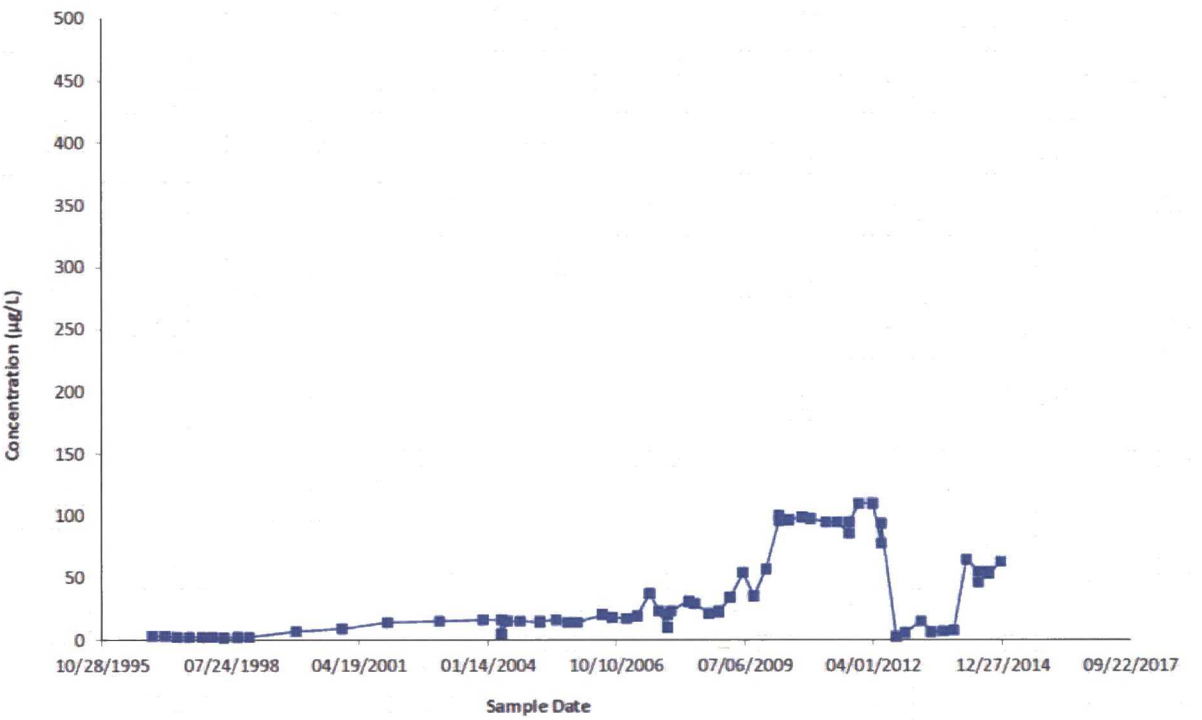
Note:
(1) Non-detect results are presented as half of the reported detection limit.
(2) Duplicate results are presented as separate graphing points.

Chemical Analysis of Carbon Tetrachloride in MW3S



Notes:
(1) Non-detect results are presented as half of the reported detection limit.
(2) Duplicate results are presented as separate graphing points.
(3) Large-scale bioremediation pilot study was completed between June 2005 and July 2009.

Chemical Analysis of Trichloroethene in MW12D



Appendix G: Screening-Level Risk Evaluation Table

COC	ROD Cleanup Goal (mg/kg)	Commercial/Industrial RSLs (mg/kg)[b]		Screening-Level Risk Evaluation[d]	
		Risk-based (1×10^{-6})	Noncancer HI	Risk-based (1×10^{-6})	Noncancer HI
Arsenic	48	3	480	0.000016	0.1
Barium	360	--	2200000	NA	0.000163636
Cadmium	6	9300	980	6.45161E-10	0.006122449
Carbon tetrachloride	3,689 µg/kg	2,900 µg/kg	570,000 µg/kg	1.27207E-06	0.00647193
Chloroform	15,865 µg/kg	1,400 µg/kg	1,000,000 µg/kg	1.13321E-05	0.15865
Chromium	140	6.3	3,500	2.22222E-05	0.04
1,2-Dichlorobenzene	1.5	--	9,300	NA	0.00016129
Lead	1.3	--	800	NA	0.001625
Mercury	0.15	--	46	NA	0.00326087
Us Aroclor 1254	10	0.97	15	1.03093E-05	0.666666667
Selenium	4.6	--	5,800	NA	0.000793103
Silver	0.6	--	5,800	NA	0.000103448
Vinyl chloride	14 µg/kg	1,700 µg/kg	370,000 µg/kg	8.23529E-09	3.78378E-05

Notes:

a. Values are EPA's RSL for carcinogenic and noncancer effects available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015 (accessed 3/22/16).

b. Screening level risk evaluation:
Risk = (Cleanup criterion/RSL)(1×10^{-6})
HI = (Cleanup criterion/RSL)

-- criterion not developed for this chemical.

NA not applicable because chemical has not been classified as a carcinogen.